SCIENTIFIC AMERICAN

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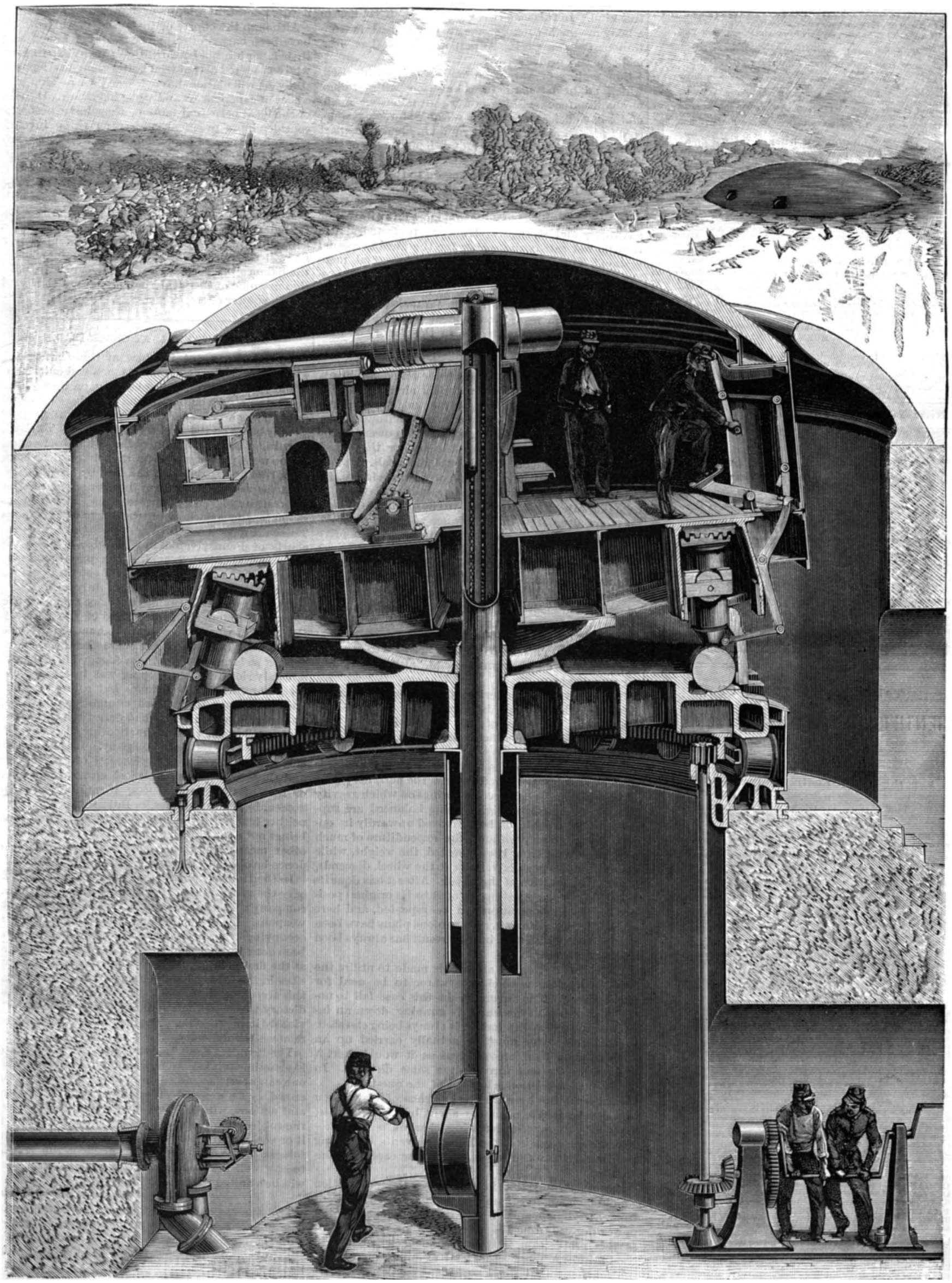

THE DISAPPEARING TURRET FOR COAST-DEFENSE GUNS.—Fig. 1.—[See page 69.]

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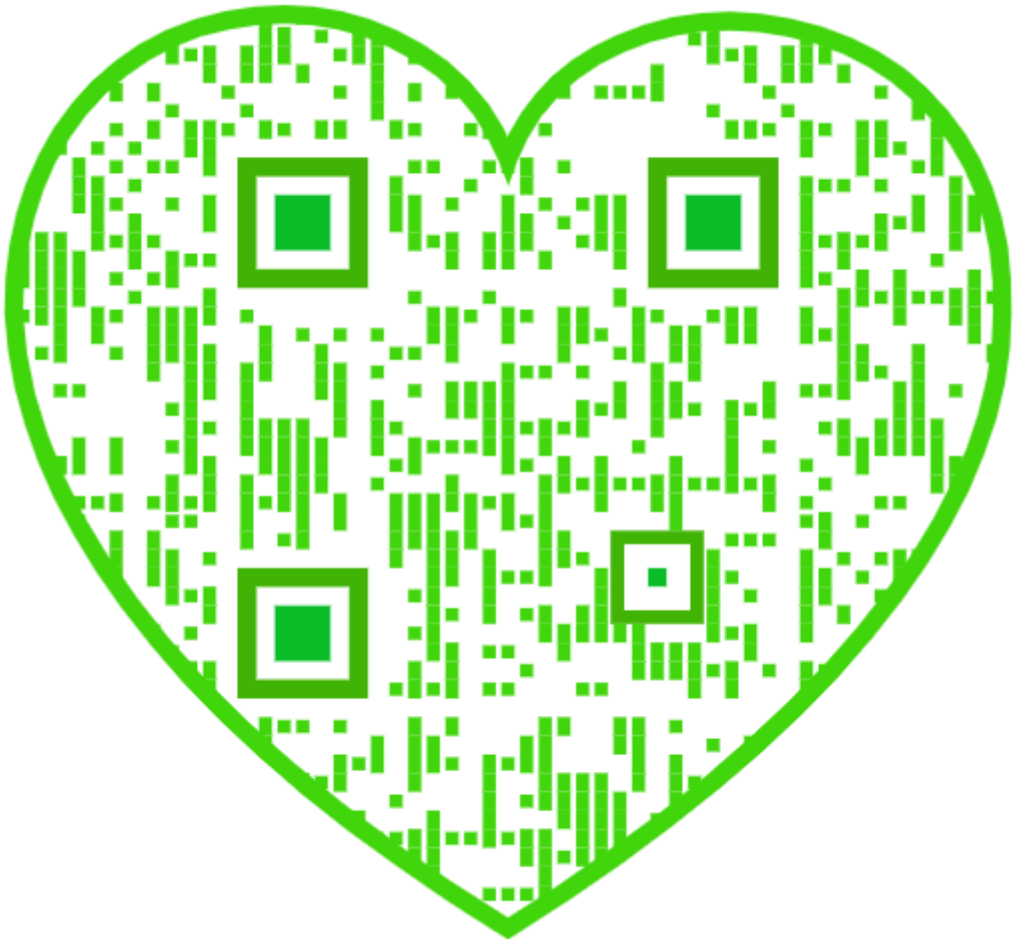

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IS PERPETUAL MOTION POSSIBLE?

The reply to this question depends entirely upon the limitations put upon the term "perpetual motion." If we understand these words to mean a machine that would start itself, furnish power for doing work, and continue in operation so long as required, or until worn out, without the assistance of any external agency, we may say with the utmost confidence, perpetual motion is impossible.

If, on the other hand, we define perpetual motion as a machine dependent for its action upon the variability of one or more of the forces of nature, we may say perpetual motion is possible. The thermal motor, in which expansion and contraction are produced by natural changes of temperature, is an example of a motor of this kind. In this machine, the changes in volume in a body are made to store energy to be used in continuous regular work. A perpetual clock has been made on this principle.

Sun motors of various forms have been devised, which might be used in connection with storage mechanism for furnishing power continuously. A sun motor of sufficient size with a suitable storage system, could furnish power the year round in almost any part of the world; success being a question of hours of sunshine and capacities of motor and storage system.

Of course, what is said with regard to the sun motor applies with equal force to water wheels, windmills, tide and wave motors. Without doubt, all of these prime movers will come more and more into use as time advances, and storage systems are perfected. Still they do not satisfy the seeker for the ideal perpetual motion. This should fill the conditions first mentioned; but, as we have already said, this is an impossibility.

The first and strongest reason for making this positive assertion in regard to the ideal perpetual motion is found in the fact that never in the history of man has he been able to make a single atom of matter, or create the smallest fraction of a unit of energy.

All the works of man, of whatever name or nature, have been constructed of materials already in existence, and all the work done by man and his enginery has been accomplished by using current natural forces, such as the gravitation of water, the power of the wind, and the heat energy of the sun, or the stored energy of coal and other fuels or of chemicals.

Having the command of some of nature's forces, inventors have sought to circumvent nature's laws, so as to make water "run up hill," to cause masses of matter to act alternately in accordance with and in opposition to the law of gravitation; in short, to deprive matter of gravity while ascending, and cause it to act with the full force of gravity while descending.

Among perpetual motion devices of this class, proposed and tried, is the one having weights arranged on a wheel in such a way as to fall outwardly and increase the leverage on one side of the wheel, while they fold in and diminish the leverage on the opposite side of the wheel. This machine, it is needless to say, has never moved on its own account, although it has become classic.

In this device, the superior number of weights on the side where the leverage is least exactly balances the weights at the ends of the extended arms. This is true of all the modifications of this type of machine.

A favorite device of the perpetual motion inventor is that of weights arranged around the periphery of a wheel and counterbalanced by springs on which gravity has no effect. Such weights being balanced are supposed to be capable of being moved upwardly in opposition to gravity without the expenditure of much power. After having been elevated, the weight, while maintaining its position relative to the wheel, descends, causing the rotation of the wheel. After it has done its work the weight must be restored to its original position before the operation can be repeated, and here comes the rub. Many very ingenious plans have been tried to accomplish this, but the result has always been a perfect balance.

In another device the attempt is made to utilize the Archimedean screw to elevate water to be used for driving itself. The inventors in this case fail to notice that although the water is running down an incline in the screw, this incline is always being elevated, so that the water must be actually carried up an inclined plane by a force as great as it would exert if allowed to descend through the same distance. In all these cases friction is left out of the question.

Capillarity has been tried as a means of elevating a liquid to be used as a motive agent, but in this case, as in all others, the defeating element is present—the surface tension of the liquid prevents detaching the liquid from the upper end of the capillary conductor.

It seems strange that in these days the proposition should be made to run an electric motor with a current from a dynamo and to operate the dynamo by the power derived from the electric motor, yet, absurd as this proposition is, it has often been broached in good faith. A mere superficial examination of this subject shows that the losses incurred in transforming the current into motive power, and *vice versa*, are such as to defeat any attempts of this kind.

The permanent magnet appears to have suggested itself to many as a possible solution of the problem, and experimenters have searched the world over to find an insulator of magnetism to act as a cut-off for releasing the armature after it has been drawn forward toward the magnet; but no such material has been found. Nature, in this case as in all others, refuses to yield energy without its full equivalent of energy in some other form, and the law of the conservation of energy is found to hold good.

We have mentioned but a few of the multitude of devices constructed with the hope, not to say expectation, of producing a self-moving machine by utilizing nature's constant and unvarying forces.

Although the efforts of inventors in this direction have been barren of results of the kind aimed at, yet their labor has not been fruitless; many experimenters who considered actual trial better than any amount of study or calculation have learned that "knowledge comes of experience," and while discovering the fallacy of the ideal perpetual motion, they have been led to consider more practical subjects; making inventions which have proved beneficial to the world and profitable to themselves.

If the inventor of machines intended to be self-moving will not accede to Newton's statement that "action and reaction are equal and opposite" (third law of motion), and that there is a perfect and wonderful balance in the forces of nature, let him thoroughly acquaint himself with the principles of physics, and he will erelong be able to say with certainty just how the balance will occur in any and every perpetual motion machine of the ideal kind, and admit that he has not the power of creating energy.

THE CAMERA AT HOMESTEAD.

During the recent troubles at the Carnegie iron works, a mob broke down a fence and entered upon the premises to resist the landing, on the company's grounds, of men employed and sent there by the company, and who were being conveyed to their destination by boats on the Monongahela River. Twelve men were killed outright and more than a hundred wounded. Who were participators in this murderous engagement? Who first violated the law, by breaking down the fence and entering upon the grounds of the Carnegie company? Who carried arms, and who used them, in the attack upon the boats which followed? These are questions which are now to come before the courts of Pennsylvania, in a number of cases which have been instituted against the participants in the bloody work which took place at the Carnegie works in the early morning of the 6th of July last.

It is said the company has evidence sufficient to convict against more than a thousand of the active participants, of whom more than two hundred were armed with guns. But what is the character of this evidence against so large a body of men engaged in a fierce, in a bloody riot, when everything was in a state of the greatest excitement? It takes but a line to state it, and at the same time afford unquestionable proof of its high character: "We had detectives with cameras in the mill at the time of the shooting," says Secretary Lovejoy, of the Carnegie company. It is always difficult to obtain competent witnesses of exciting frays, and those who know the most, either from interest or fear of the consequences, invariably have phenomenally bad memories. But the camera knows neither fear nor favor, never becomes excited, and it brings out a multiplicity of details. Probably by no other means could such effective corroborative evidence be obtained in cases of this kind.

In the Homestead case the rioters were scattered all over the grounds near the landing place, within the company's premises, armed with guns and other weapons. They were behind fences, in the trees, and occupying other positions of advantage as would have been done in an actual battle. As Judge Magee said at the first hearing, "There were sharpshooters with rifles in the field, picking off men." But to prove all this according to the old methods, with all the contradictory witnesses that would be offered, would be obviously impracticable. The instantaneous photograph removes the difficulty.

The "camera fiend," as the amateur photographer is sometimes styled, is now almost omnipresent, and one can never be sure when in any public place, in a crowd, or at a scene of excitement, but his person and actions, with all the surroundings, will become the subject of a picture which, whether he might like it or not, would have the stamp of undeniable truthfulness. The disclosures to be made on the trials, as to how well the camera did its work at Homestead, will be awaited with much interest.

THE amount of coloring matter in a pound of coal is enormous. It will yield enough magenta to color 500 yards of flannel, vermilion for 2,560 yards, aurine for 120 yards, and alizarine sufficient for 155 yards of Turkey red cloth.

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POSITION OF THE PLANETS IN AUGUST.

MARS

is morning star until the 4th, and then evening star. His opposition with the sun occurs on the 4th, at 1 h. 21 m. A. M. He is then, as the word opposition implies, opposite the sun, rising at sunset, reaching the meridian at midnight, and setting at sunrise, being visible the entire night. As in July he increased in brilliancy when approaching opposition, so in August, after passing opposition, he will decrease in brilliancy, the process being reversed in the two months. The conditions are more favorable for August than July, as the planet is approaching perihelion during the whole month. Mars is nearest to the earth on the 6th, when he is 34,900,000 miles distant, about 100,000 miles nearer than on the 4th. He is retrograding or moving westward, as observers who carefully note his path in the sky will see. We can add nothing to what has already been said respecting this planet and the wonderful opportunity for observing him under conditions that will not take place again for seventeen years. It is surely not too much to expect that a discovery as unexpected as that of 1877 may reward some unwearied worker in the Martian field, and rejoice the hearts of those who find unceasing enjoyment in the study of the stars!

The moon is in conjunction with Mars the day before the full, on the 7th, at 11 h. 4 m. P. M., being 1° 52′ north.

The right ascension of Mars on the 1st is 21 h. 9 m., his declination is 23° 26′ south, his diameter is 26″.6, and he is in the constellation Capricornus.

Mars rises on the 1st at 7 h. 48 m. P. M. On the 30th he sets at 2 h. 30 m. A. M.

JUPITER

is morning star. He will be a bright and shining light on August nights, for he is near perihelion and approaching opposition. He rises about two and a half hours later than Mars on the 1st, and although he has to yield the first place to his ruddy rival, he will, as soon as he appears above the eastern horizon, share with Mars in the admiration freely bestowed by star gazers upon both planets. The opportunity is favorable for comparing the light power of the two planets. Jupiter, when brightest, gives out two and a half times more light than Mars, probably on account of the reflecting power of his cloud atmosphere, that hides the body of the planet from view, while the real surface of Mars is probably seen. Under the present conditions, with Mars at nearly his greatest possible brightness, and Jupiter nearly two months from opposition, the light-giving power of the two planets is about equal. The conditions are excellent for making the comparison. Mars is on the meridian on the 4th at midnight, and Jupiter at half past 4 o'clock in the morning. There is more satisfaction is observing the latter planet, for he is about 30° farther north. Jupiter is stationary on the 13th, and then retrogrades or moves westward. The two planets will afford a rich field for study and investigation during the whole month.

The moon, two days before the last quarter, makes a very close conjunction with Jupiter on the 13th, at 2 h. 26 m. A. M., being 2′ north. The conjunction is visible, and so close that it will be an appulse, moon and star seeming to touch each other.

The right ascension of Jupiter on the 1st is 1 h. 34 m., his declination is 8° 16′, his diameter is 41″.0, and he is in the constellation Pisces.

Jupiter rises on the 1st at 10 h. 15 m. P. M. On the 30th he rises at 8 h. 17 m. P. M.

VENUS

is morning star. Her period of retreat when she was hidden from view was short, and when the month commences she is far enough away from the great source of light to be a beautifnl object as she appears above the eastern horizon two hours before the sun. As the month advances she rises earlier and increases in luster until she reaches her period of greatest brilliancy on the 15th at 10 h. A. M. This event occurs thirty-seven days after her inferior conjunction, when she is 39° west of the sun, and one-fourth of her illuminated disk is turned toward the earth, her light number being 187·6. Venus, as morning star, repeats in reversed order the much-admired phases of her course as evening star, passing from inferior conjunction to greatest brilliancy, as she previously passed from greatest brilliancy to inferior conjunction. Observers find it hard to decide which phase is the more beautiful. In the one she follows the sun, and sinks slowly below the western horizon. In the other, she precedes the sun, rising above the eastern horizon, and shining brightly until her light pales in the glowing dawn. Venus, as evening star, finds more admirers, largely from the convenience of the time for observation.

The moon four days before her change is in conjunction with Venus, on the 18th, at 7 h. 9 m. P. M., being 9° 45′ north.

The right ascension of Venus on the 1st is 6 h. 40 m., her declination is 16° 44′ north, her diameter is 47″.4, and she is in the constellation Gemini.

Venus rises on the first at 2 h. 53 m. A. M. On the 31st she rises at 1 h. 53 m. A. M.

MERCURY

is evening star until the 25th, and then morning star. He is in inferior conjunction with the sun on the 25th, at 10 h. P. M., when he ends his short course as evening star and passes to the sun's western side.

The right ascension of Mercury on the 1st is 10 h. 31 m., his declination is 7° 12′ north, his diameter is 8″.0, and he is in the constellation Leo.

Mercury sets on the 1st at 8 h. 9 m. P. M. On the 31st he rises at 4 h. 43 m. A. M.

SATURN

is evening star. He is closely approaching the sun, and when the month closes sets an hour later than the sun. The moon, when two days old, is in conjunction with Saturn on the 24th, at 1 h. 55 m. P. M., being 1° 19′ north.

The right ascension of Saturn on the 1st is 11 h. 52 m., his declination is 3° 13′ north, his diameter is 15″.0, and he is in the constellation Virgo.

Saturn sets on the 1st at 9 h. 16 m. P. M. On the 31st he sets at 7 h. 25 m. P. M.

URANUS

is evening star. The moon makes a close conjunction with the planet on the 27th at 10 h. 11 m. A. M., being 11′ north.

The right ascension of Uranus on the 1st is 14 h. 1 m., his declination is 11° 48′ south, his diameter is 3″.5, and he is in the constellation Virgo.

Uranus sets on the 1st at 10 h. 31 m. P. M. On the 31st he sets at 8 h. 36 m. P. M.

NEPTUNE

is morning star. His right ascension on the 1st is 4 h. 38 m., his declination is 20° 33′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune rises on the 1st at 0 h. 36 m. A. M. On the 31st he rises at 10 h. 36 m. P. M.

Mars, Jupiter, Venus, and Neptune are morning stars at the beginning of the month. Saturn, Mercury and Uranus are evening stars.

Mechanical Refrigeration.

At the recent meeting in San Francisco of the American Society of Engineers, a paper was read by Professors Denton and Jacobus on the performance of refrigerating machines, in which, among other valuable conclusions, they show that a pound of coal used to make steam for a fairly efficient refrigerating machine can produce an actual cooling effect equal to that produced by the melting of 16 to 46 pounds of ice, the amount varying with the conditions of working. Commenting on this paper, the *Engineering News* says:

"To put the same facts differently, 855 h. u. per lb. of coal converting into work in the refrigerating plant (at the rate of 3 lb. coal per h. p. hour) will abstract 2,275 to 6,545 h. u. of heat from the refrigerated body. The waste of cold in actual ice making is such that the production of ice per pound of coal is about half this, or somewhat more if the ice is not made from distilled water. Ice making is far from being the sole use of refrigerating machines, however; in fact, now that the efficiency and reliability of mechanical refrigeration is proved, it wants only an appreciation of its advantages by the public to bring it into much more extended use than it has yet received.

In a paper on "The Ventilation of Buildings," by Mr. Alfred R. Wolff, M. Am. Soc. M. E., the author allowed 2,000 cu. ft. of fresh air per hour per person as sufficient for fair ventilation. With the air at an initial temperature of 80° F., its weight per cubic foot will be 0·0736 lb.; hence the hourly supply per person will weigh 2,000 × 0·0736 lb. = 147·2 lb. To cool this 10°, the specific heat of air being 0·238, will require the abstraction of 147·2 × 0·238 × 10 = 350 h. u. per hour. These assumptions may be accepted as correct, except as to the temperature to which the air should be cooled. Probably a temperature of 70° on a hot summer day would cause frequent complaints of cold; a maximum reduction of 10° from the external atmosphere is, however, a proper basis to calculate upon, at least for office buildings. Thus the necessary cooling effect calculated by Mr. Wolff may be accepted as correct.

Taking the figures given by Messrs. Denton and Jacobus for the refrigerating effect per pound of coal as above stated, and the required abstraction of 350 h. u. per person per hour to have a satisfactory cooling effect, the refrigeration obtained from a pound of coal will produce this cooling effect for 2,275 ÷ 350 = 6½ hours with the least efficient working, or 6,545 ÷ 350 = 18·7 hours with the most efficient working, the ammonia plant being used in either case, and compressed air being much less efficient. With mechanical refrigeration, if we assume 10 hours' cooling per person per pound of coal as a fair practical service in regular work, we have an expense of only 15 cts. per thousand persons per hour, coal being estimated at $3 per short ton. Of course, this is for fuel alone, and the various items of oil, attendance, interest and depreciation on the plant, etc., must be considered in making up the actual total cost of mechanical refrigeration. But, on the other hand, by the use of the most economical machinery, a much higher efficiency than that which we have assumed or than the highest given in the authors' table ought to be possible, as they have allowed a coal consumption of 3 lb. per h. p. hour.

These figures are sufficient, however, to prove the practicability of artificial cooling for office buildings, hospitals, theaters, hotels, and even for the best class of private houses. It is a curious example of the slowness with which people take advantage of modern inventions that thousands of men sit sweltering in hot offices in the midsummer days; business lags and the efficiency of workers whose time is worth many dollars per hour is greatly reduced. At the same time not more than three or four blocks away are great provision warehouses where the temperature is kept at freezing the year round, and at a very moderate cost. If it pays to keep dead ducks and turkeys cool on Greenwich Street, why would it not pay to keep live business men cool on Broadway?

What They Think of It.

Our contemporaries have universally commended to their readers the value of the "Scientific American Cyclopedia of Receipts, Notes and Queries," as a work of reference for engineers, mechanics, and households. The Boston *Journal of Commerce*, a newspaper of large circulation and influence in the New England States, has this to say of it:

"This splendid work contains a careful compilation of the most useful receipts and replies given in the notes and queries of correspondents as published in the SCIENTIFIC AMERICAN during the past fifty years, together with many valuable and important additions. Nearly every branch of the useful arts is represented. It is by far the most comprehensive volume of the kind ever placed before the public. The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form, convenient for ready use. Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered. Instructions for working many different processes in the arts are given. Many of the principal substances and raw materials used in manufacturing operations are defined and described. No pains have been spared to render this collateral information trustworthy. Those who are engaged in any branch of industry probably will find in this book much that is of practical value in their respective callings. Those who are in search of independent business or employment, relating to the home manufacture of salable articles, will find in it hundreds of most excellent suggestions. In fact, the book is an overflowing treasury of practical scientific information, and is worth many times its price to scientific students."

Eruption of Mount Etna.

Mount Etna is at present very active, and it is thought by those competent to judge that a terrible outbreak is impending. The inhabitants of Catania, of Nicolosi, and the surrounding country are in a state of consternation. Twelve houses and a portion of a large church have been destroyed. Shocks are frequent, and a fissure has opened at the summit and a stream of lava is rapidly flowing down the sides of the mountain, threatening to overrun the village of Rinazzi.

It is thought that the first outbreak of this mountain occurred in the seventh century before Christ, and from that time on many disasters are known to have resulted from its outbursts.

In 1669, the city of Nicolosi was converted into a heap of ruins. A fissure 6 ft. wide and of unfathomable depth opened in the side of the mountain. In 1693 there was another great outbreak which leveled Catania to the ground and buried 18,000 of its inhabitants. At this time fifty towns were destroyed in Sicily, and the total loss of life amounted to nearly 100,000. The last eruption occurred in 1868.

The Power of Lightning.

On August 1, 1846, St. George's Church, Leicester, which was a new building, was entirely destroyed during a thunder storm. The steeple having been burst asunder, parts of it were blown to a distance of thirty feet in every direction, while the vane rod and top part of the spire fell perpendicularly down, carrying with them every floor in the tower, the bells and the works of the clock. The falling mass was not arrested until it arrived on the ground, under which was a strong brick arch, and this also was broken by the blow. The gutters and ridge covering were torn up, and the pipes used to convey the water from the roof were blown to pieces. Mr. Highton calculated the power developed in the discharge of the lightning which destroyed this church with some known mechanical force. He discovered that a hundred tons of stone were blown down a distance of thirty feet in three seconds, and consequently a 12,220 horse power engine would have been required to resist the efforts of this single flash.

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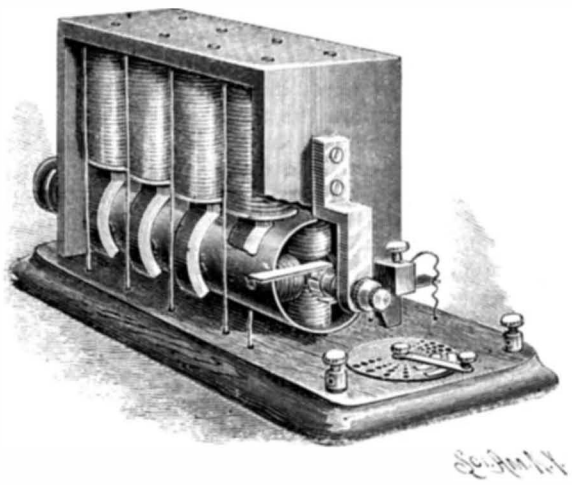
AN EASILY REGULATED ELECTRIC MOTOR.

The simple and effective motor shown in the illustration, in which the current may be readily regulated and easily reversed, has been patented by Mr. Harlon F. Ong, of Newberg, Oregon. It has a compound field magnet formed of a series of field magnets furnished with separate polar extensions, a compound armature formed of a series of armatures arranged upon a shaft and corresponding in position with the polar extensions of the field magnets, and a multiple switch for sending



ONG'S ELECTRIC MOTOR.

the current through one or more of the field magnet sections in either direction. A commutator is connected electrically with the armature sections formed of two rings, each divided at diametrically opposite points, the divisions of one-half arranged ninety degrees distant from those of the other part, and a pair of commutator brushes is held in contact with both of the commutator rings. By moving the switch arm a limited distance to the right, the current from the battery passes in one direction through one section of the field magnet; by moving the arm farther the current flows through two sections, in the same direction, and so on throughout the series. When the switch arm is moved to the left, the current is made to flow in the opposite direction, thereby reversing the direction of rotation of the armature, the current being sent in a similar manner, as desired, through one or more sections of the field magnet, whereby the power of the motor is regulated.

Mr. Edison Honored.

The London Society of Arts prize, consisting of a medal, the prize having been founded in memory of the Prince Consort, has been awarded to Thomas A. Edison. The medal has previously been awarded to Faraday, De Lesseps, and many of the other great scientists.

A COMFORTABLE READING CHAIR.

In using the chair shown in the illustration, the occupant is supposed to sit crosswise of the seat, as one would sit in a saddle, resting the elbows on the arm-pieces near the top of the back, the book then being supported in a convenient position for reading on an inclined table attached to the rear uprights. Such a chair in a library or study, or elsewhere, affording convenient opportunity for such changes of position from the usual posture as are often sought, cannot fail in many cases to contribute materially to one's comfort. The picture is very nearly a representation of a chair used for many years by the Duke of Wellington, at Walmer Castle, England, and now carefully preserved there. The duke died at this castle September 14, 1852.

A DUKE OF WELLINGTON" CHAIR.

The Use of Eyeglasses.

One of the first concomitants of age is acquired far-sightedness or presbyopia. This necessitates wearing certain glasses for near work.

Whenever a man or woman about forty-five years of age finds himself or herself reading or threading a needle at arm's length, their action tells that the little muscle governing the accommodation is growing weak and needs assistance. By persisting in forcing this muscle to work, much injury is done to the eyes, but by having it corrected, many a frown would be saved to man and many a wrinkle to woman.

Not only is it important to get glasses, but of more importance still is it to see that you get the kind suitable for each eye. It is comparatively rare that you find two eyes exactly alike, and the aid of an ophthalmic surgeon, who is not only competent theoretically but practically, should be sought.

Men whose knowledge is acquired by long experience are often much more useful than those having a theoretical knowledge only. When the optician finds, however, that the vision is not the same in each eye, or where astigmatism exists, and patient complains of symptoms now recognized as eye symptoms, then his province ends and the ophthalmic surgeon's work begins.

At one time the druggist could exercise the prerogatives of the physician; is it of lesser import that the optician should assume the prerogatives of an ophthalmic surgeon? If the law now prevents the one from prescribing drugs, the other should also be prevented from prescribing glasses, outside of a certain range of years or certain physiological conditions.

As age increases, excessive reading, writing, or work upon very small objects must not be persisted in, especially if the eyes grow tired. It must be remembered that the elasticity of the eyeball is lost, and any persistent effort may produce hemorrhage in the retina, or such a strain as may lead to other serious troubles.

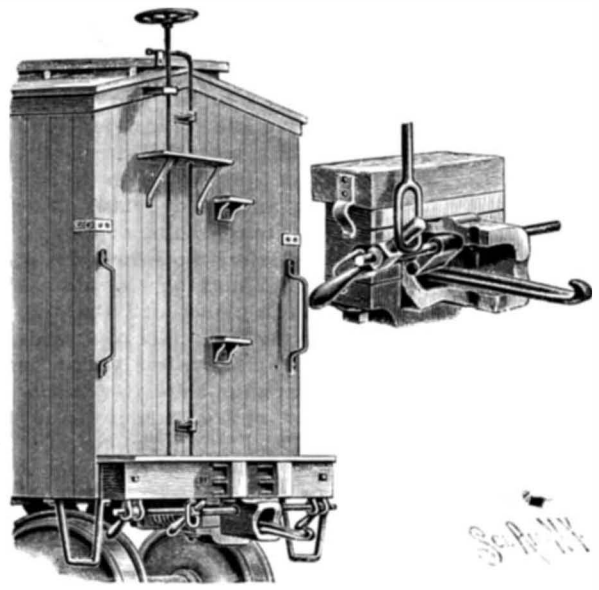
Old people should be careful not to read with a strong artificial light falling on a white glazed surface. And the *Industrial World* concludes: It would be better for such people if our monthly magazines were printed on paper of a neutral tint.

Not as Easy as it Seems.

You may not think it is much of a task to be foreman or superintendent of a factory or other manufacturing establishment, says the *American Machinist*, but try it and see, and you will find that it is not the easy job it may seem to the observer. Imagine yourself with from fifty to a hundred men, or even less, and plan out each day's work so as to have work ready for the men as fast as the last job is finished. You must estimate the time it will take this man to finish the job, so the next man can have it in time to start on with it as soon as his present work is completed. You must judge of the time a man should occupy on a job, and also the cost of material in the same, must know whether he is making it right or not, and whether at his present rate he will get it done in time for shipment according to contract. If not, he must have help on it. When you consider all these features, the responsibility of managing the whole place, and, if the judgment proves faulty, of being solely responsible for the loss, it is not an easy task after all.

AN IMPROVED CAR COUPLING.

The coupling shown in the illustration is designed to be simple and durable in construction, very effective in operation, and easily operated for coupling or uncoupling from either the side or the top of the car. The improvement has been patented by Mr. Reuben Quatermass, of Moline, Kansas. The coupling link is in the form of a flat bar, with its ends somewhat narrowed, and on each end a turned-up head forming a hook, the link also having a longitudinal slot adapted for engagement with an ordinary coupling pin when connecting with a car on which is used the pin and link coupling. Secured on a transverse shaft, journaled in bearings in the drawhead, is a plate whose rounded-off lower end is adapted to engage the hook of the coupling link, the edges of this plate having pins which move in segmental grooves at its side in the drawhead, as the plate is swung upward and downward, by means of handles at the side on the transverse shaft, or the rod connected with this shaft which leads to the top of the car. When the plate is held horizontally the link is disengaged, but when it is at an angle of about forty-five degrees it is free to engage the head of the link. The shaft on which the plate is held is journaled in elongated openings, so that when a pull is exerted on the plate by the link, the upper or outer end of the plate will abut against a bearing in the under side of the top of the drawhead, thus relieving the shaft of all strain. On each of the handles at the sides is a link adapted to engage a hook on the car, to lock the shaft and plate in position, and one of the handles is preferably adapted for engagement with a spring catch to facilitate the engagement or detachment of the link. When the plate is in its lowermost position, an entering link swings it backward until it passes the head of the link and drops into engagement therewith, the handles adding weight to the plate to hold it in engagement with the link. In uncoupling, the cars are backed till the link slides rearward, when the handles are turned to swing the plate upward out of engagement with the link. In case of one of the cars leaving the track, the turning of the link to one side



QUATERMASS' CAR COUPLING.

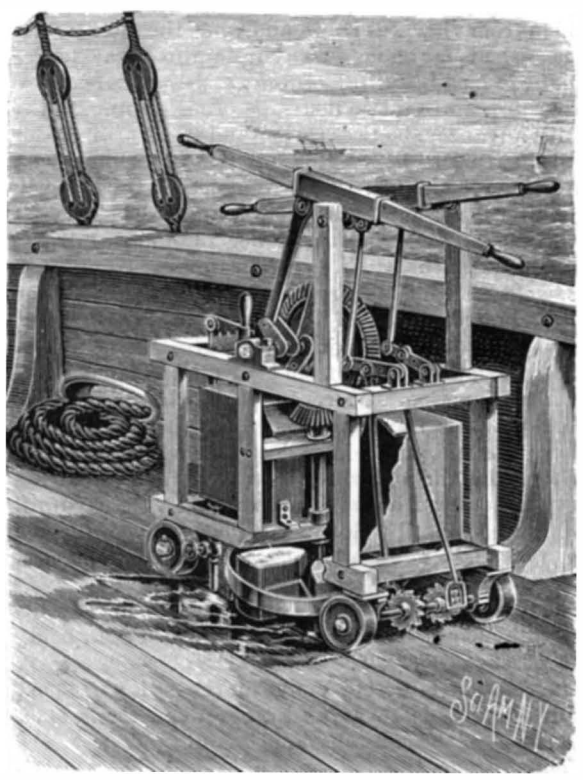
would effect its disengagement, so that the following car would not be derailed.

A MACHINE TO HOLYSTONE A VESSEL'S DECK.

The illustration represents a machine by means of which holystones may be moved in any direction across and in frictional contact with the surface of a vessel's deck, being rotated and resting freely thereon, while water and grinding material are at the same time supplied in their path. A yoke extends upwardly from one axle of the machine and is attached to a vertical shaft terminating in a crank arm, by means of which the machine may be steered, the crank arm being adapted to engage a rack. A transverse shaft, having two crank arms near the center of the frame, is connected by links with walking beams above, and the crank shaft has an attached bevel gear meshing with a bevel pinion on the upper end of a vertical shaft to which is attached a stone carrier, consisting of a skeleton frame containing a number of pockets. In the pockets are loosely fitted the stones, which feed downward by gravity as their under surfaces are worn away. By the rocking of the walking beams a rotary motion is given to the carrier containing the holystones, whereby the deck may be expeditiously cleaned.

Within the frame of the machine are held two tanks, one containing water or other liquid, and the other an abrading material, each tank feeding its contents in suitable proportions, according as the valves in their discharge pipes may be adjusted. The machine is moved forward and backward by means of dogs engaging ratchet wheels on the axle at one end, the upper ends of the dogs being adjustably and pivotally attached to levers fulcrumed on the frame, these levers being connected by links with the walking beams.

Further information relative to this improvement may be obtained by addressing the patentee, Capt. Samuel Lowberg, in care of Mr. E. C. Benedict, No. 29 Broad Street, New York City.



LOWBERG'S DECK-CLEANING MACHINE.

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The Apricot Industry in Damascus.

The city of Damascus is surrounded by gardens which are composed of fields of apricots, furnishing an average yield of from 50,000 to 65,000 quintals of fruit. M. Guillois, the French consul at Damascus, says that the harvest lasts about six weeks, generally from the 10th of June until the end of July. There are six principal descriptions of apricots, the *Sendiani*, *Hamoni*, *Onazari*, *Chahmi*, *Baladi*, and *Klobi*. The *Sendiani* appears the first, about the middle of June. It is an oval fruit of a yellow color and of a slightly acid taste. It is consumed exclusively at Damascus. The kernel of this description of apricot is not bitter to the taste.

The *Hamoni*, which follows immediately after the *Sendiani*, is the most appreciated. It is small, round, with a glossy skin, and the fruit is perfumed and juicy. This variety, like the former, is consumed at Damascus, and it is subdivided into two categories, the *Hamoni bakir* and the *Hamoni lakisse*.

The *Onazari* is slightly oval, red, juicy, and perfumed, and resembles the European apricot. The kernel of this description is large, and of a sweet taste, and is easily detached from the fruit. The price of the *Onazari* is about a sixth higher than that of the preceding varieties, and part of this fruit is consumed at Damascus and the remainder is sent to Beyrout. The three varieties enumerated above are almost entirely used for home consumption, and in a fresh state; while the following descriptions are largely used in the manufacture of preserves, for drying, and for making apricot paste.

These are the *Chahmi*, which externally resembles the *Hamoni*, but is inferior to it as regards taste, the fruit being dry, and wanting in perfume.

The *Baladi*, which resembles the *Onazari* in form and taste, is yet considered to be superior to the latter. The yield of this fruit is about 5,000 quintals, and of this quantity 1,000 quintals are consumed in the fresh state at Damascus, the remainder being used for making dried apricots (*Noukou*) which form one of the principal articles of export from Damascus. This fruit is gathered from the tree when it is completely matured generally about the 15th June. It is then exposed for three days to the sun on planks, covered with a layer of long straw, care being taken to keep the apricots apart, so that they may not touch one another. The third day, each apricot is gently pressed between the palms of the hands, and again exposed to the rays of the sun, and this operation is repeated until the fruit, perfectly dry, assumes the shape of a flattened disk. This usually takes place in about six or eight days, and the apricot loses about 70 per cent of its weight. The price of the dried apricot varies between 30 centimes and 1 franc the kilogramme at the time of drying; but at other times, and particularly in the month of Ramazan, when there is a large consumption of the article, the price is doubled. A small quantity of these dried apricots is used in the manufacture of preserves. The remainder is exported to Egypt, Smyrna, and Constantinople, to a value of about £3,200.

The *Klabi*, which is a very inferior quality of apricot, is a small, dry, red fruit, and is the only one in which the kernel is bitter. It is exclusively used in the preparation of apricot paste. Apricot paste, known as *Kamar el Dine*, is, together with dried apricots, one of the principal exports from Damascus. The fruit, when gathered, is crushed in a kind of large iron wire sieve, and the thick juice which results from this operation is collected in earthen vats, and then spread on planks covered with a layer of oil, where it is allowed to remain two days exposed to the air. At the expiration of this time the paste is removed and turned. On the fourth day the paste is again removed, and it then has the appearance of a band of leather, very thin, and of a reddish-brown color, about a yard and a half long and half a yard wide. This is the finest quality of paste. The same operation is repeated once or twice to obtain a second and third quality, each time a little water being added to the residuum of the former operation. The bands of paste are then folded so as to form bundles of about 5 pounds weight, which are sold according to quality—from 35 to 55 francs the quintal. In the same way as dried apricots, apricot paste is exported to Egypt, Arabia, Aleppo, Constantinople, and also to Belgium. The value of the export amounts annually to about £14,000.

As regards the kernels of the apricots, part of these is consumed at Damascus in the manufacture of oil, and the remainder is shipped to France, Germany, Italy, and Austria, the value of this export trade being estimated at £8,000. The value of the yield of apricots in Damascus, after allowing for expenses, is estimated at £28,000. These figures, says M. Guillois, are sufficient to show the importance of apricot culture in the immediate environs of Damascus, and in his opinion they might be doubled, if an improved system of culture and irrigation were adopted.

Tests of Rubber Hose.

The tests made recently by the Cleveland Rubber Co., with regard to the best sorts of hose for particular purposes, resulted as follows:

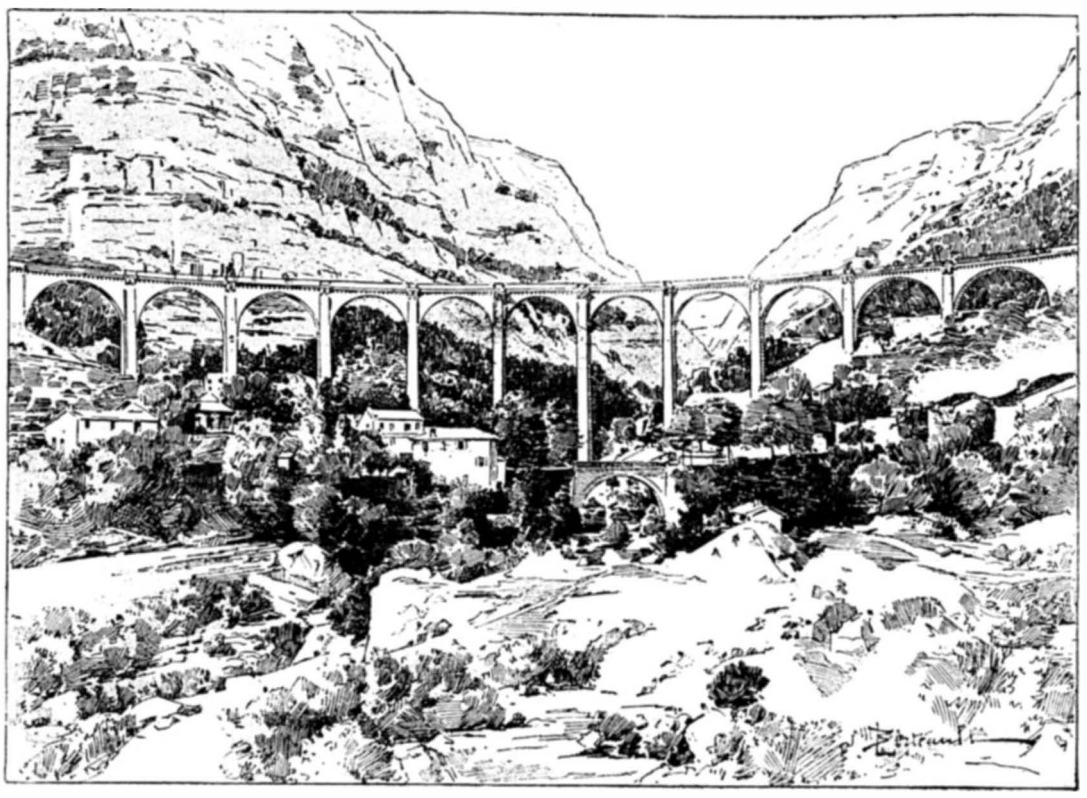
Where a pressure of 25 pounds or less is used, four-ply should be ordered for 1¼ inch and smaller sizes, and five-ply for 1½ inch and larger sizes.

Where a pressure of 60 pounds or less is required, five-ply should be ordered for 1¼ inch and smaller sizes, and six-ply for 1½ inch and larger sizes.

Where the pressure exceeds 60 pounds, add one ply for each additional 10 pounds of steam. Where 90 pounds or more pressure is required, the hose should be duck-covered and wire-bound.

THE VIADUCT DU LOUP.

A new railway line has lately been opened in the South of France, between Nice and Puget Theniers and Grasse, a distance of 62½ miles. It passes through a mountainous and picturesque region, full of lovely sheltered valleys, celebrated for numberless gardens of roses, violets and jasmines, from which the choicest perfumes are made. The new road has been constructed at great expense. A number of tunnels and bridges have been required. We illustrate one of the latter, the viaduct Du Loup, which carries the rails through the valley of the same name.



THE VIADUCT DU LOUP.

This structure is composed of masonry, of eleven arches of about 63 ft. span, built on a curve of about 675 ft. Height, 170 ft.; length, 1,050 ft.

Hop Growing in Bohemia.

The United States consul at Prague, in a recent report, says the large breweries all the world over always keep in their storehouses at least a small quantity of Bohemian hops, although the price paid is frequently a high one. This fact is a high tribute to the excellence of the Bohemian product, the superior qualities of which are attributed to peculiarly favorable conditions of soil and climate, and to careful and well tried methods of culture. Since the sixteenth century hops have had their home in Bohemia, and their fame, then already established, has been maintained and increased, and hop growing still continues to occupy a position of the first importance among the various forms of agriculture. The hop gardens are not extensive, and hop growing is confined to a comparatively small area, while the so-called hop belt is a limited one. The total area under this cultivation amounts, according to the latest statistical returns, to about 26,000 acres, and this is divided into districts known under the names of the cities around which they center. The largest and the best known is the Saatz district, with an area of about 10,000 acres. The neighboring district of Rakonitz, with an area of about 600 acres, produces a grade of hops very similar in quality to that of the Saatz district; then come the Auscha district, with an area of about 4,000 acres, the product of which is not considered as good as the Saatz hops; and the Dauba district, with an area of some 2,500 acres, producing an inferior grade of hops.

The most celebrated of these districts is the Saatz, and the hops grown there are claimed to be the best in the world. The hops of the Saatz district are again subdivided into *Stadt*, *Bezirks*, and *Kreis* classifications, according to quality, and the *Stadt*, or city hops, are the highest grade, while the *Kreis*, or circuit hops, are supposed to be somewhat inferior. In the Saatz and Rakonitz districts the hops are grown under similar conditions, and the products differ very little. The hops grow in a ferruginous, reddish clay soil, along the banks of the River Eger, while the region is protected from the cold north winds by a spur of the Erzgebirge, and the only prevailing winds are from the west and southwest. The elevation is about 800 feet above the sea level, and the mean temperature during the year about 7° Reaumur. The excellent qualities of the hops are ascribed to the peculiar properties of the soil and to the very slight atmospheric depression. The hops of the Saatz, Rakonitz, and Auscha districts are all known under the general name of red hops, while the Dauba hops are called green hops. The distinguishing marks of the Saatz hops are a long flower, closed at the top with innumerable leaflets—from a hundred to a hundred and fifty—which are as soft as velvet to the touch. They are characterized by a delicate spicy aroma, and the bitterness is greatly appreciated. The flower, when ripe, is of a greenish yellow color, with a slight reddish tint. Dauba hops, the type of green hops, have a round flower with fewer leaflets—from forty to sixty—and the odor exhaled somewhat resembles garlic. The color of the ripe flower is of a yellowish green. Red hops form three-fifths and green hops two-fifths of the total crop.

Outside the regions above mentioned, the cultivation is carried on only on a small scale. The average crop in Bohemia is 9,000,000 pounds in round numbers. The average yield per acre is not large; in the Saatz district it is between 350 and 450 pounds, while in the Auscha district, in a good season, there is a yield of 600 pounds to the acre. The labor required for the cultivation is cheap, and hop pickers receive about tenpence for a day's labor. With a view to securing a uniformly higher standard of hop culture there have been established, within the last two years, technical schools for the study of hop culture at Rakonitz and at Laun. These schools receive financial support from the government of Bohemia, and also from the cities and districts where they are located. Being situated in the midst of the hop districts, every opportunity is afforded for practical work. In connection with the Rakonitz school there is an experimental hop garden, where innovations in cultivation are tried. The courses of instruction offered are both for students attending regularly and for farmers desiring special instruction. Among the regular courses of instruction are hop culture, theoretical and practical, from a botanical and practical standpoint, treatment of the soil, choice of the young plants, fastening of the poles, selection of the poles, hop picking, hop sorting, etc. The attendance at the schools has so far been considerable, and many students have come from other countries. The results have been so satisfactory that it is expected that hop culture will show a decided improvement as the schools become older and the students turn the knowledge acquired to practical use.

As an indisputable instance of the material benefit accruing to a sugar estate through the saving of fuel by the use of scientifically arranged furnaces, we are able to-day to refer to Pln. Perseverance, Essequebo, which has just had considerable additions made to its evaporating plant, including a triple effect, and its furnaces placed in order. During the present grinding there has been nothing consumed but green begasse, and all that comes from the mill is not required to supply the demand. Neither wood nor coal is wanted; and the one "coal" boiler that had been left unmodified is not used, and to all appearances is not likely to be. Those who know what the coal account of a sugar estate can amount to during a grinding season will be able to understand the enviable position a proprietor is in who can obtain all the fuel he requires from the *debris* of the canes that are giving him the sugar. At Perseverance the work of remodeling the furnaces was carried through entirely by Mr. Price Abell.—*Argosy.*

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Correspondence.

Rattlesnakes and Prairie Dogs.

To the Editor of the Scientific American:

It is often remarked that owls, prairie dogs, and rattlesnakes live amicably together in one hole, which the prairie dog is supposed to have prepared. In order to test the question of the peaceful relations between the dog and snake, an old army officer tells me that he once turned a rattler loose in his room. Opening the cage of the prairie dog, the little fellow at once came out and ran back and forth immediately in front of the reptile, which was coiled with its head poised ready to strike the dog. The snake followed the dog's movements with its head. The dog's eyes were constantly directed toward the snake's eyes. After a time, the movement of the snake's head from side to side grew slower. It seemed to have become confused or dizzy from the continued exercise. With a quick spring the dog seized the snake's neck close to the head and bit it viciously. He continued biting the snake along the spinal cord from neck to tail, the first bite having practically ended the snake's life. When the dead reptile was swung to and fro from the bars of the dog's cage, the animal tried to ward it off with his fore feet. These actions convinced the officer that the dog appreciated the dangerous qualities of the snake. This observer also thought that snakes did not strike adult dogs when living with them because the holes were too small to maneuver in. M. Y. BEACH.

San Diego, Cal., July 1892.

History of Table Utensils.

How many persons there are who do not know, or at least know but vaguely, that the manner of taking meals has not always been the same as it is at the present time, and that most of our table utensils are of quite recent origin. We shall briefly discuss this subject in speaking successively of all the objects that in our day constitute the equipment of a well-served table.

Let us, in the first place, speak of the table. Every one knows that the Romans took their meals in lying upon very low couches that somewhat resembled what we call a lounge. When we say that they lay down, our statement is not exactly accurate, since cushions permitted them to change position frequently, for it would have been very difficult for them to abandon themselves to the pleasures of the table in constantly occupying a horizontal position.

When Gaul was conquered by the Romans, the latter introduced their habits into the provinces subdued by them, and it was not till about the time of Charlemagne that the guests at a repast seated themselves upon cushions around a stand in order to take their meals. At the homes of the great, these cushions and stands were relatively elegant as regards decoration. The table made its appearance later on, in the middle ages, accompanied with benches provided with backs, which were placed all around the board. At first, the table was not covered with a cloth, and napkins likewise were unknown. The first that mention is made of were manufactured at Reims, and offered to Charles VII. at the time that he was crowned there, thanks to Joan of Arc. They became quite common under Charles V. and Francis I.

The Greeks and Romans were acquainted with plates, or rather with a sort of porringer, and yet, during a portion of the middle ages, people made use of slices of bread cut round, which took the place of plates. This practice is again spoken of in the coronation ceremonies of Louis XII., at the beginning of the sixteenth century. After the repast this bread was given to the poor.

The spoon must date back to a very ancient epoch, for, although it is always possible to eat solid food with the fingers—a very ancient and very natural practice—the same is not the case with a liquid or semi-solid aliment, and it is not possible that the famous Lacedemonian black broth was consumed otherwise than with a sort of spoon. Moreover, spoons have been found at Pompeii and in several excavations and notably in the famous treasury of Hildesheim. In a much remoter antiquity, the Egyptians, in the seventeenth century before the Christian era, used spoons for mixing certain powders with beverages. These spoons, of which quite a large number are in existence, were remarkable for their generally fine and very rich ornamentation. The Museum of the Louvre possesses several of them.

The use of spoons in France was not generally adopted until toward the end of the fourteenth century, but there is a question of this in the will of Saint Remi, who baptized Clovis in 496. The use of the knife is very ancient, and the first that we know of were of hard stone. Herodotus tells us that the knives used by the Egyptian surgeons were likewise of stone. Yet the use of the knife among us as a table utensil does not date back to a very ancient epoch. Although there was a famous cutlery works at Beauvais in the tenth century, it does not appear that the knife was much used upon the table. At this epoch, and for a very long time, the blade was fixed and inclosed in a sheath. It is not two centuries since the use of clasp knives became common. The tables were not provided with them, and each person carried his own. This custom has been preserved even in our day in some distant provinces, by old men, who, when they go to dine out, take their knife from their pocket and use it skillfully during the whole course of the meal. Such are evidently exceptions, which are daily tending to disappear, yet they serve to show the rarity of the knife, to within a short period, upon the tables of persons belonging to the lower classes. The fork was absolutely unknown to the Greeks and Romans, who, for taking their solid food, used their fingers, which they washed in basins. The meats were served cut in pieces of varying size, and each one divided the piece that he had before him as best he could with his fingers.

In the middle ages, the fork appeared only as a curiosity, and the use of it was not as yet the same as that to which it is now put. It was employed for eating fruit or slices of bread and cheese.

We find a few forks figuring in the treasury of John II., Duke of Burgundy; and Galveston, a favorite of Edward II., of England, owned, says a historian of the time, sixty-nine silver spoons and three forks for eating pears with. Again, we find quite numerous traces of the existence of forks in the middle ages, but they were never used for eating meat. At this epoch they had but two tines, and it is from that circumstance that is derived their name of *fork*.

Henry III. was the first to use forks upon the table. He had a certain number of silver ones made, and the use of the article spread very quickly at court. It must be added that such use was regarded as quite ridiculous by the public, as may be seen from the following passage from a satire upon the court of Henry III.: "Firstly, they never touched meat with their hands, but with forks, and they carried it to their mouth in bending forward the neck and body upon their seat. They took salad with forks, for it is forbidden in that country to touch meat with the hands, however difficult it may be to take, and they prefer that this little forked instrument, rather than their fingers, shall touch their mouth."

Despite the morose criticism that we have just cited, the use of the fork rapidly extended, and the fact must be recognized that it was not without good reason.

Since the remotest antiquity, cups have been employed at banquets for the beverages drank thereat. They were of metal, more or less precious, according to the wealth of the amphitryon.

In the middle ages, drinking glasses and cups were very rare. They were generally mounted upon a foot or stem, of gold or silver, enriched with precious stones. It was not till the fifteenth century, the epoch at which Venice began to spread abroad her products, that the use of glasses became more general, yet, in ordinary life, people continued for a long time to use tin drinking vessels, which were often of beautiful workmanship, and which figured with other utensils, likewise of tin, upon the dressers and buffets of the lords.

The custom of setting several glasses before each person, for the different wines that are to be served, belongs to the nineteenth century. In the eighteenth century the glass was dipped, at each new wine, into small earthenware vessels filled with water, and which were placed upon the table within reach of the guests.

The salt cellar dates back to remote times, and that is natural, since the use of salt is lost in the night of time. Homer qualifies it as divine. Among the Greeks and Romans, it occupied the place of honor at banquets. Among the wealthy, it was of silver or gold, and was handed down from father to son. Benvenuto Cellini chased some for Francis I. that were of the most exquisite workmanship. There are likewise some beautiful specimens in faience, and at the Louvre may be seen those made at Orion for the celebrated set called the service of Diana of Poitiers or of Henry II.

Although salt cellars were likewise made of very common earthenware, Olivier de la Marche tells us that, at ordinary repasts, the salt cellar was often a piece of bread hollowed out to receive the salt, and which was placed near each guest.

As for the caster or cruet stand, which was unknown to the ancients, it has been impossible for us to find out to what epoch it dates back. It is probable, however, that it is not older than the sixteenth century.

Such is the origin of the utensils that are now to be found upon the humblest tables, and it will be acknowledged that a notable progress has been made in the manner of taking one's daily food.—*La Science en Famille.*

Basic Steel.

Speaking at the meeting of the Iron and Steel Institute, at London, Mr. Andrew Carnegie said that an exhaustive series of tests just undertaken by the Pennsylvania Railway had placed basic steel alongside of acid steel for boilers and fire boxes, and he had been informed that the question was being seriously entertained whether they would not specify that nothing but basic steel should be used for those purposes. He considered that so far as the United States had proceeded in armor it was merely experimental. They had not made enough material. So far it was true that they thought that the admixture of the nickel in certain proportions did give one quality to the steel, viz., tenacity, so that shots passing through it did not crack it, but were held in. With regard to the harveyizing, they had harveyized a few plates, but the result was a matter to be decided in the future. They had gone to this extent in America. A few experimental plates had been made, and while one part of the plate had shown extraordinary results, the other part of the plate had not. He, therefore, wished to disclaim for America any share of extraordinary credit for anything it had done in armor. What it might do the future would show.

Items of Interest.

The streets of London, if put end to end, would reach from that city to St. Petersburg.

The lighthouse tower at Cape Hatteras is 189 feet high from its base to the center of the lantern. It is the tallest lighthouse tower in existence.

A new telegraph cable has been laid between Ellis Island and the Barge Office in this city. It is 8,000 feet long and contains four working wires. It was made in Paterson, N. J., and is covered with an imported insulating material.

In a recently invented watch for the blind, a small peg is set in the middle of each figure. When the hour hand reaches a given hour, the peg for that hour drops. The owner, when he wants to know the time, finds which peg is down and then counts back to XII.

The Swedish government has adopted a new smokeless powder which is said to have the following advantages: it is easy of manufacture, produces no flame, and does not heat the rifle. It gives the ball an initial velocity of 2,100 feet with a pressure of 2,260 atmospheres.

According to M. Flammarion, the French astronomer, the mean temperature of Paris during the past six years has been about two degrees below the normal. It is also stated that Great Britain, Belgium, Spain, Italy, Austria and Germany have also been growing cold.

Some attention has been directed to a paper read by Dr. Leo Bergenstein, of Vienna, before the late hygienic congress, on "The Working Curve of an Hour." To demonstrate the fluctuation of brain power in children, he collected two classes of little girls and two of little boys, the children's ages being eleven and twelve years, and set them to work on easy sums in arithmetic for successive periods of ten minutes, with five minute intervals of rest; then the results of the work, the calculations and the errors were carefully tabulated and compared. The total number of calculations made by all the children increased, roughly speaking, 4,000, 3,000 and 4,000 in the second, third and fourth periods, respectively. During the third period of ten minutes the increase of work done was not so great as at other periods; the number of mistakes also increased, say 450, 700, 350 in the different periods—here, again, during the third period, the quality of the work was at its lowest. It would thus appear that children of the ages mentioned become fatigued in three-quarters of an hour; that the organic material is gradually exhausted; and that the power of work gradually diminishes to a certain point during the third quarter of the hour, returning with renewed force in the fourth quarter. This experiment is regarded as demonstrating that continuous work for school children of these ages, even though the tasks are not difficult, ought not to last longer than three-quarters of an hour

The Drift of Lake Currents.

During the next few months a great many bottles will be cast upon the shores of Lake Michigan. They are to be thrown into the water for experimental purposes by lake captains, who will undertake the service at the request of the United States government. The experiments are to be conducted for the purpose of determining the set and drift of lake currents, and will be under the direction of the weather bureau. The bottles are to be given out to vessel captains, who will agree to throw them overboard and enter certain data on blanks furnished for that purpose. In order to do the work systematically, the great lakes have been mapped out in numbered sections, commencing at Duluth and numbering eastward. There are 410 sections in all, each containing about 180 square miles. When the captain throws one of the bottles in the water, he will place in it, before so doing, a slip of paper, upon which the data and the position of the vessel is entered. On each slip is the request that the finder send it to the chief of the weather bureau at Washington or hand it to the nearest government observer, lighthouse keeper or postmaster, to be forwarded. By noting where the bottles go ashore, data will be obtained from which the movement of the lake currents can be calculated.

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THE OSCILLATING DISAPPEARING TURRET.

The necessity of protecting guns of large caliber by armored turrets has been recognized for several years. Almost all fortresses are now provided with different systems of these apparatus, and we shall here merely briefly recall the fact that they consist of a large steel plate cylinder resting upon a masonry base through the intermedium of a roller path like that of a railway turn-table. This cylinder is covered with an iron cap from 8 to 10 inches in thickness, and, through an arrangement that we shall describe, is capable of taking a rotary motion around its axis by means of a very simple mechanism installed at the bottom and actuated by manual power. This motion assures of pointing in direction, and at the same time, if it continues after the firing, it permits of causing the embrasures to disappear from the sight of the enemy, and of thus exposing the weak part of the turret to his shots for a short time only. But the time during which this part remains under the fire of the adversary has appeared, with this system, still too long, and so an endeavor has been made, by different means, to shorten it as much as possible. We shall mention that especially which consists in rendering the whole of the turret movable in a vertical direction, and, by means of a sort of elevator and a counterpoise, causing it to rise at the moment of firing and to descend immediately afterward.

Commandant Mougin, engineer of the Saint Chamond works, has found another solution of the problem, which, by the simplicity of the mechanism, surpasses everything that has been done up to the present, and it is this system of disappearing turret that has just been constructed for one of the forts of Bucharest, and which is represented in its entirety in Fig. 1, on the first page. We shall try to make the operation of it understood.

As in all other turrets, we find here the cylinder covered with its cap and placed upon a turn-table pro-

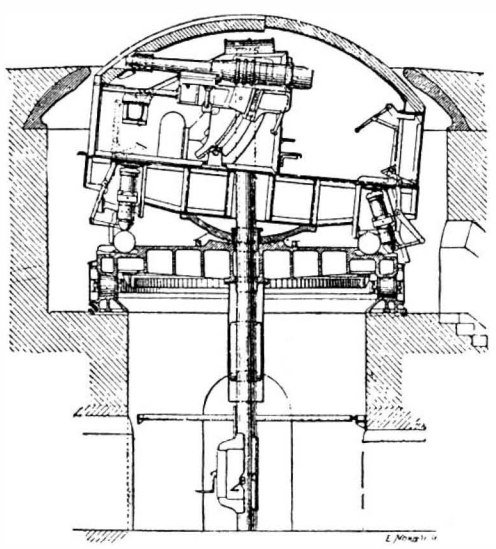

Fig. 2.—THE TURRET AT THE MOMENT OF FIRING.

vided with rollers. Two embrasures allow the muzzles of the guns that arm the turret to appear. But in order to cause these to appear or disappear as quickly as possible, the turret, instead of being placed directly upon the turn-table, rests thereon through the intermedium of a steel piece, B (Figs. 4 and 5), which is a fraction of a cylinder 14·75 feet in length and of 8·5 feet radius. The section at right angles with the axis, represented in Fig. 1, shows the arc of a circle profile of this piece, and it will be at once understood that, resting upon such a base, the turret is capable of taking an oscillatory motion analogous to that of a child's rocking horse. The extremities of this oscillation correspond, one of them, to the position of firing, and the other to the position of loading (Fig. 3).

We shall now see how this huge mass, weighing 528,000 pounds, can be placed and maintained in one or the other of these two positions with the greatest facility. To the right and left of the cylinder (Fig. 5) may be seen two supports, G. These pivot around an axis that permits them to keep a vertical position, whatever be the inclination of the rest of the system. It is these supports that *chock* the turret. They are, in fact, so arranged that when the oscillation is at its maximum, the one that is most elevated places itself, through its own weight, over a roller, H (Fig. 5), and thus prevents the motion from continuing in the opposite direction.

In order to move it from such position, it suffices to press upon a handle that actuates a series of levers, A (Fig. 5). This motion may be effected by one man, because, in all the transmissions of the levers between each other, care has been taken to avoid movements of friction. There are merely rollings upon each other of parts that are perfectly hard and polished. The same is the case, moreover, with the support, G, and roller, H, as may be seen from our engraving. At the least stress, acting otherwise than in the vertical direction, it will be seen that G will slide upon H. This is what takes place, in fact, as soon as the man selected for the maneuver, after bearing upon a safety pedal, pulls toward him the handle that controls the levers, A. If at this moment the weight of the turret is preponderant on this side, the entire system will proceed to oscillate; but it will accomplish half an oscillation only, because the support placed on the other side

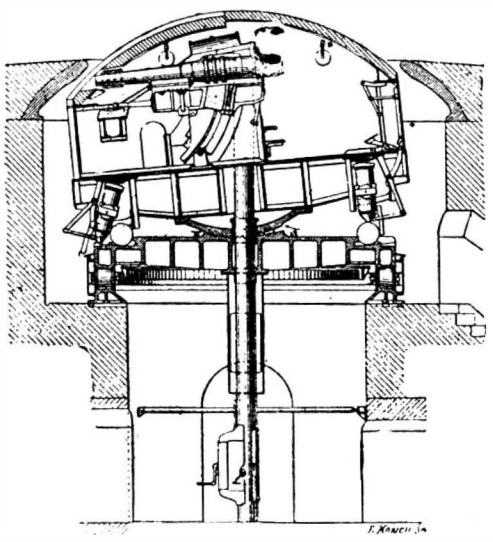

Fig. 3.—LOADING POSITION.

will produce the same effect as the one just mentioned.

Being given these arrangements, it suffices to assure the preponderance of weight of one side or the other of the turret, according to the direction in which it is desired that it shall incline.

Let us say in the first place that there is, invariably, a preponderance upon the part represented to the right in our figures, by means of masses of lead fixed thereto. It suffices, then, that it shall be possible to place or remove a weight heavier than those of the other side in order to produce the motion desired. Such weight, represented at P (Fig. 5), is suspended by a chain from an arm, R, which is independent of the oscillating system and which is connected with the stationary tube, T, that occupies the center of the turret, and in which the charge and the projectiles are lifted. The chain from which the counterpoise, P, is suspended passes over pulleys and ends beneath at a windlass, M, which is maneuvered by two or three men. In the other figures these arrangements are not represented, as they would have hidden important details. Figs. 3 and 5 represent the turret in the position of disappearance. The gun has just been fired and is about to be reloaded. During this time, men placed at the windlass, M (Fig. 5), raise the weight, P, to a certain height. The rest of the system will not budge, since it is chocked to the right by the support, G. But, as soon as all is ready, one of the men will bear upon the lever mechanism that controls this support; the weight, P, being raised, will have no more action, and the part to the right having the preponderance, as we have said, the turret will oscillate on this side, and will take the firing position shown in Fig. 2. The shot will be fired at once. But, upon reaching this position, the floor of the turret will be inclined, and will rejoin the weight, P. A special arrangement (not visible in the figure) having at this moment automatically thrown the windlass, M, out of gear, this weight will rest upon the floor and will assure a preponderance on this side of the turret. As soon as the support that keeps it in the firing position is raised, it will again assume the disappearing position.

We just spoke of the tube that occupies the center of the turret and is situated between the two guns

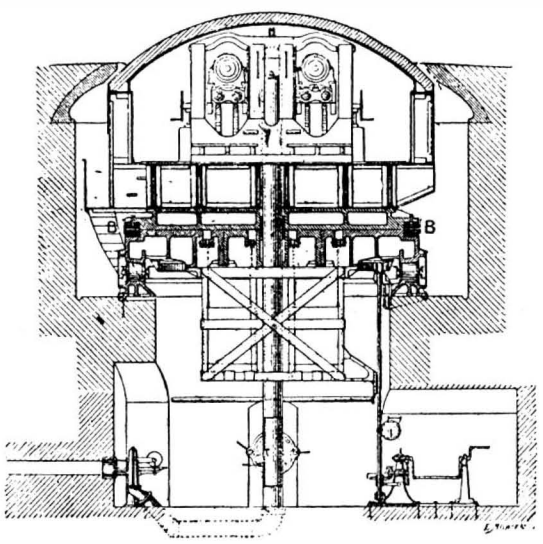

Fig. 4.—SECTION OF THE TURRET TO THE REAR OF THE TWO GUNS.

(Fig. 3) that arm the latter. As we have said, this tube is immovable, and it will be seen from an examination of Figs. 2 and 3 that, in consequence of the motions of oscillation of the turret, it is in the vicinity of the breech of the guns only during the position of disappearance, which is also that of firing. It is through the intermedium of this tube, and by means of a special windlass, that the ammunition is raised. It is utilized also for ventilating the turret by means of a small turbine that may be seen at the bottom and to the left of Fig. 1.

We shall now, in a few lines, recapitulate the very simple maneuvers of the turret.

The firing is directed by an officer standing in an external observatory connected telegraphically with the turret. Here there is a sub-officer who directs the maneuvers, but who, as regards pointing, merely executes the orders of his superior without seeing the effect produced. For direction, a graduation of the circle is indicated to him, and he causes the turret to be revolved, by means of a windlass placed to the right, until it reaches the desired degree. And so too for pointing in elevation, he lowers or raises the breech to the degree indicated. As for the firing, that is done electrically by pressing a button.

As may be seen, the artillerymen are reduced here to the role of a wheelwork interposed between the commandant and the gun. Completely isolated from the outside, they mechanically execute a firing of which they see neither the object nor the effects.

In becoming scientific, the art of war, like the industry from which it borrowed its processes, has had to specialize individuals and reduce their initiative, and, while admiring the ingenuity of the new inventions, we cannot help averring that they are tending more and more to cause the disappearance of whatever of the picturesque and poetic battle might have. We can no longer think, without shuddering, of the moral state of these few men, inclosed in this carapax of iron, when the enemy's projectiles strike the wall of it, when deafened by the fearful shaking of this huge bell, suffocated by the heat, and obliged to keep their ventilator in continuous operation, lest they be completely smothered. They run the risk at every moment of being buried alive by a breakage of commu-

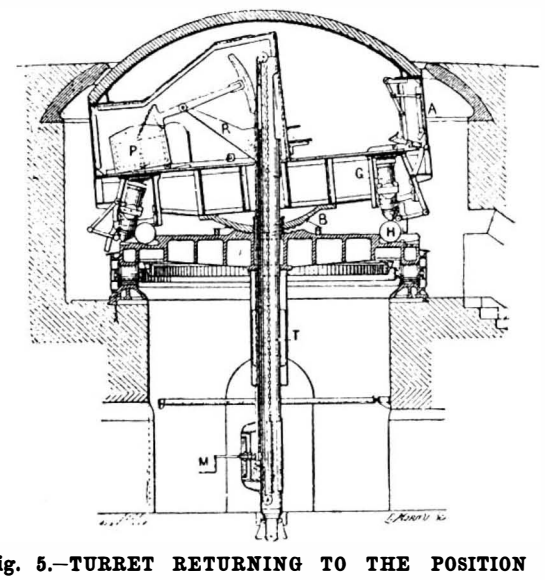

Fig. 5.—TURRET RETURNING TO THE POSITION OF DISAPPEARANCE THROUGH THE AGENCY OF THE COUNTERPOISE.

nications or a stoppage of the mechanism. Doubtless the wars of the future will have their heroes, but heroism will have changed nature, like war itself and its apparatus, and victory will be the triumph of the mechanic.—*L'Illustration.*

Chloride of Zinc for Tuberculosis.

M. Lannelongue's treatment of tubercular diseases, as brought under the notice of the Paris Academy, is essentially based on the simple fact that fibrous induration is to be regarded as the natural curative process of tubercular change; and it having been found that chloride of zinc is peculiarly apt to excite such sclerotic processes when administered in sufficiently small quantity—two or three drops of a 10 per cent solution—so as to obviate its more powerful escharotic action, this substance has been employed, yielding very satisfactory results in external tuberculosis, and its application in the case of pulmonary tubercle is, according to M. Lannelongue, equally encouraging. It would appear from the accounts given of this treatment that the tubercular formation itself is less influenced by the agent—which has no specific property—than are the healthy tisues that surround the tubercles. The aim of the Lannelongue method is, therefore, to induce the formation of a densely fibrous investment to active tubercle, and by this process to limit the diseased product, and as it were to imprison the bacilli.

The New Postal Card.

The Morgan Envelope Company, Springfield, Mass., has the contract for 24,000,000 double postal cards, a new device which has long been considered by the Post Office Department. The card will be five and one-half by three and one-half inches, and will be folded in the middle, presenting four surfaces. The outside surface is for the address and the inside for the message. At the fold the card is perforated, so that the recipient will tear off one half and then answer on the other.

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MECHANICAL SINGING BIRDS.

The first automatic birds are quite old, and a remarkable specimen of them exists at the Conservatoire des Arts et Metiers. We represent this herewith (Fig. 1). It dates back to the last century. The birds are inclosed in a cage, and the mechanism is contained in the base of the latter.

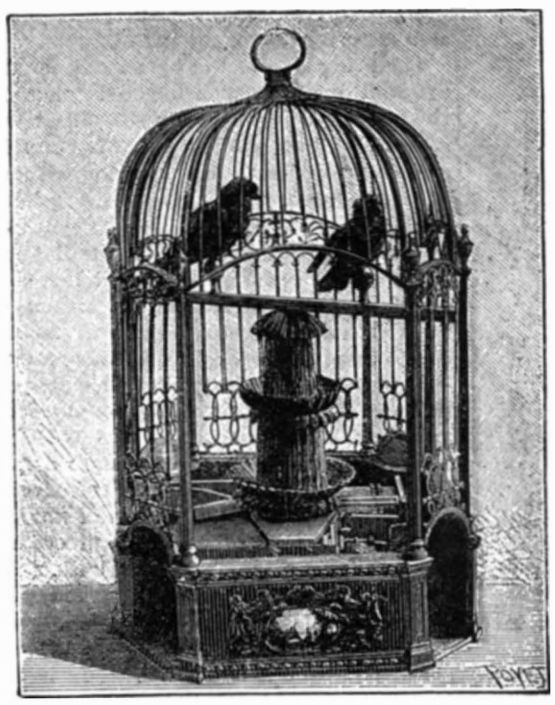

Fig. 1.—MECHANICAL SINGING BIRDS OF THE EIGHTEENTH CENTURY.

The construction of such birds has now reached great perfection.

In the first place, let us speak of the external appearance of these little automatons. At first sight, the bird is absolutely like the natural one, whose plumage it borrows, whether it represents a simple nightingale or is adorned with the brilliant feathers of a bird of paradise. Neither in the pose nor the form could the art of the taxidermist do better. The attitude of each species is carefully studied and leaves nothing to be desired, even by the most fastidious ornithologist. Certain of these birds are inclosed in a simple cage or are placed upon a branch forming a perch, while others, placed upon a tree, flutter from one branch to another, without it being possible to see the little rod, mounted upon a pivot and hidden in the leaves, that carries it back and forth. Again, others may be placed upon a stand (Fig. 2), or, owing to the small size of their pedestal, in a basket of flowers. There are others (and these are humming birds) that are concealed in a snuff box (Fig. 3), and which, when the cover of the latter is raised, suddenly appear and begin to sing. After the air is finished, they re-enter the box and the cover closes of itself. The snuffboxes in which they are inclosed are decorated in all possible ways, with inlaid enamel work, Japanese designs upon silver and gold, old silver, repoussé work, inlaid work, etc. All styles are put under contribution, and especially the Louis XV. and Louis XVI. in gilt silver.

A very ingenious model is the one that we represent in the form of a pistol (Fig. 4). When aim is taken with the pistol, and the trigger is pulled, the bird, which was first concealed in the barrel, makes its exit, sings its song, and then re-enters the weapon.

The first automatic singing birds had a motion of the bill only, and it was by means of a bird organ or a music box that they seemed to sing. As nothing better was to be had, these had to answer; but they really produced no illusion. Several types of this kind, of the time of Louis XV., are in existence.

The invention of the true automatic singing birds, and the improvements afterward introduced by Mr. Bontems, consisted in the substitution of a genuine warbling for the music box, and in giving these little singers the perfect appearance of life. A reproduction of the true song of all birds has been successfully obtained, and we have been enabled to hear all our ordinary artists, with the repertory peculiar to each of them; the nightingale, the blackbird, the chaffinch, the canary, the lark, the goldfinch, the bullfinch, and the warbler, and, among exotics, the tanager, the chewit, etc. We shall now explain the principle of the mechanism with which it has been possible to reproduce the modulations of the song of birds, and which we may observe is the same for every song.

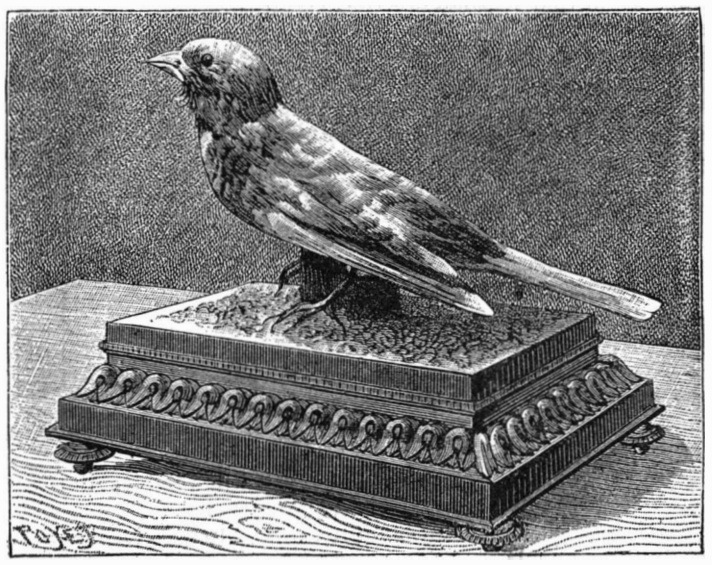

Fig. 2.—MECHANICAL SINGING BIRD OF MODERN CONSTRUCTION.

Fig. 5 gives a general view of the apparatus with its principal parts. The clockwork movement, consisting especially of a spring coiled in its barrel, is placed at M. It sets in motion an axle, A, that carries a star wheel or eccentric, B, which, through the levers, D, and the rods, H H, communicates motion to the bird. These rods turn the head, open the bill, make the tail waggle and cause the wings to flap; and the various motions do not take place at hazard during the song, but are naturally combined with the warbling that occurs at the same instant. This warbling is produced as follows: The same axle that carries along the star wheel revolves, at the same time, two coupled wheels, C, which, irregularly toothed, cause the piston or whistle (3) to act through the rod, G, and the regulator of the bellows, F, to act through the rod, E. The longer it takes the teeth to pass, the longer the valve is open and the longer the bellows (No. 2) is actuated. The motion of the teeth is communicated to the rods, G and E, behind the support, S.

It will be understood that the song of the bird may differ so long as th two wheels, C, have not made a revolution, but that the same song must then begin again at the second revolution of the wheel, the same teeth commencing again to actuate the rods, G and E. There has been an improvement introduced that consists in placing upon the same rod three pairs of wheels instead of one pair, and, when the air noted upon the first pair is finished, in bringing the following pair, by means of a snail, in front of the levers, where it replaces the one that has just been driven forward.

Fig. 3.—MECHANICAL BIRD IN A SNUFFBOX.

In order to be complete in this explanation, let us add that the intermission in the song is produced by the lever, P, which acts upon the bellows, and that the latter itself is actuated by a ratchet placed behind the box, M, of the motor. The apparatus that we have just described is the same for all birds. It is larger or smaller, more or less strong, and is placed in one direction or another, according to the space left free in the mechanical piece, but the principle does not change. In each bird, and especially when it is a question of a new song to be created, the delicate point of the adjustment is the whistle, aided by the bellows and piston, that will give the true character of the song and modulate it so as to make it rapid, sharp, grave or slow. It will be understood that the whistle may vary in diameter and length and have a more or less rapid escapement of air, so that its effects may be modified.

We have said that in snuff boxes, pistols and other small objects in which a singing bird and its mechanism are concealed, the opening of the object causes the bird to make its exit and to begin its song. It is here a question of a curiosity, and no attempt is made to produce an illusion, but rather astonishment. In the other birds, always exposed and visible, it suffices to press a detent placed behind the box, M, to set the apparatus in motion or to stop it. Of course, this detent does not produce its effect unless the clockwork movement is wound up. The little mechanical songster, whose plumage leaves nothing to be desired, when placed either in a cage or in a spray of flowers or foliage, gives the illusion of life very accurately.—*La Nature.*

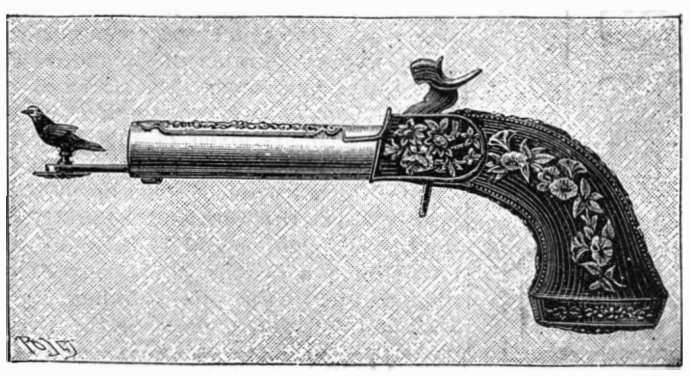

Fig. 4.—MECHANICAL BIRD MAKING ITS EXIT FROM A PISTOL.

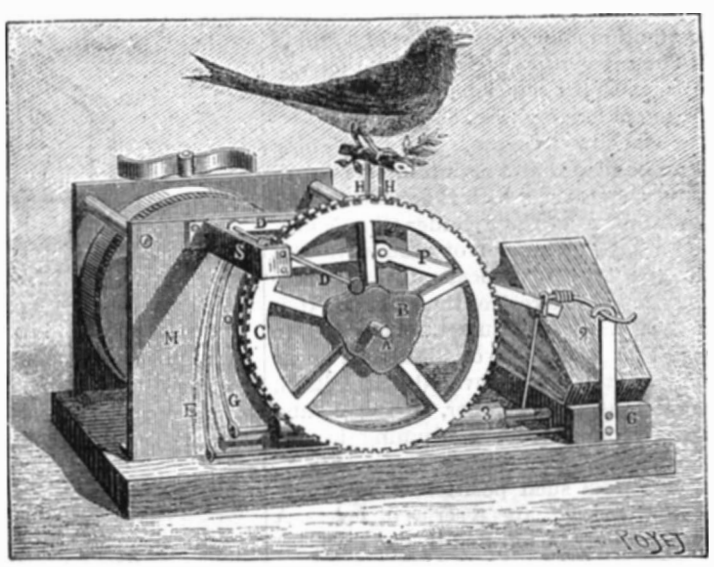

Fig. 5.—MECHANISM OF A SINGING BIRD.

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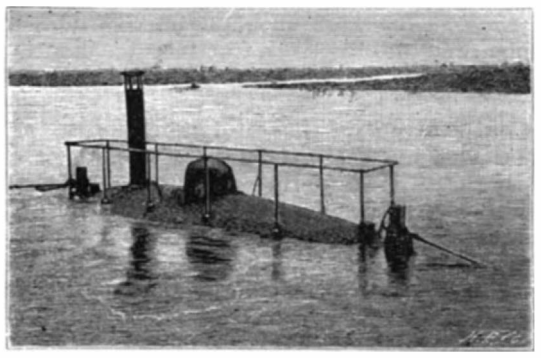
THE BAKER SUBMARINE BOAT.

During the past three months several trials have been made in the Detroit River, near Detroit, of the Baker submarine boat, shown in the accompanying illustrations, and, at the direction of Commodore Folger, of the Naval Ordnance Bureau, Mr. W. Scott Sims, an inventor well known in connection with the Sims-Edison torpedo boat, is looking into the capabilities of this new boat as affording a possibly valuable addition to the navy. The boat has needed some repairs since its preliminary trials, and, as soon as these are effected, it is expected that it will be taken to Newport and placed under the supervision of government officials for further experiments.

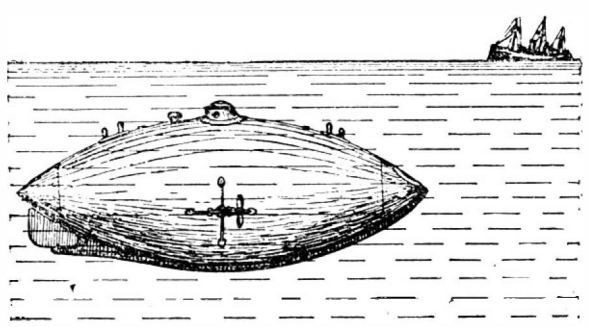


SUBMARINE BOAT—AFTER PARTIAL SUBMERGENCE.

Mr. George C. Baker, the inventor of the new craft, is a Chicago business man. The hull is designed to withstand the pressure of the water at a depth of eighty to a hundred feet, and with this view it is constructed of three-inch oak plank, six inches wide. Its dimensions are 40 feet over all, 9 feet beam and 14 feet deep, from top of conning tower to bottom of hull being 16 feet. The boat is self-contained throughout, and needs no shore connections to drive it. The driving power is in duplicate, an electric plant and a steam plant, the former for running under water and the latter for surface propulsion, the steam plant being so arranged that it can be used to generate electricity for charging the storage batteries.

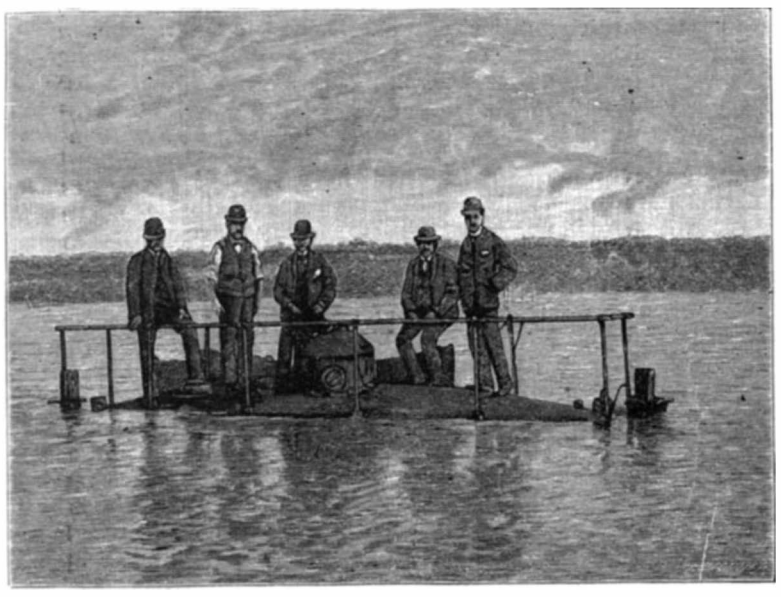
The electrical equipment consists of a 50 horse power motor, built by C. D. Jenney, of Fort Wayne, Ind., and 232 Woodward storage cells of the "M. S." type. The motor was designed for a pressure of 220 volts and runs at a maximum speed of 900, turning the two screws, which are four-bladed, at a maximum speed of 300 revolutions per minute. This rate of revolution, it was calculated, would give the boat a speed of from eight to nine miles per hour. The gearing is very substantial and of steel. The motor is connected to run as a dynamo by the simple movement of convenient switches. When it is run as a generator it is speeded up to 1,025 revolutions per minute, so as to give a charging pressure of 220 volts. The cells are charged in four sets of 58 each and are discharged in two sets of 116 cells each, this arrangement giving at the motor an available pressure of 232 volts. In the top of the boat, within easy reach of the pilot's assistant, there is a convenient controlling switch connected with galvanized sheet iron resistance coils in the forward end of the boat. By this switch and a circuit breaker the speed may be varied as desired.

The steam plant consists of a 4½ by 5½ foot Roberts water tube boiler, with telescopic stack, which is lowered and the stack hole covered when fire is not required. The 7 × 7 inch Willard engine can be thrown in gear with the main shaft, and it can also be belted to the motor. There are two 24-inch propeller wheels, one on either side, connected with one shaft amidships. To the ends of the shaft are attached gear wheels, working in the gear attached to propellers, which are turned in any position by means of a sleeve around the shaft. This sleeve is connected to a hand wheel with chain belting. By means of this hand wheel the propellers may be placed in any position. The propellers are protected by brackets from coming in contact with any obstruction. The rudder fits close to the hull and the boat answers to it readily.



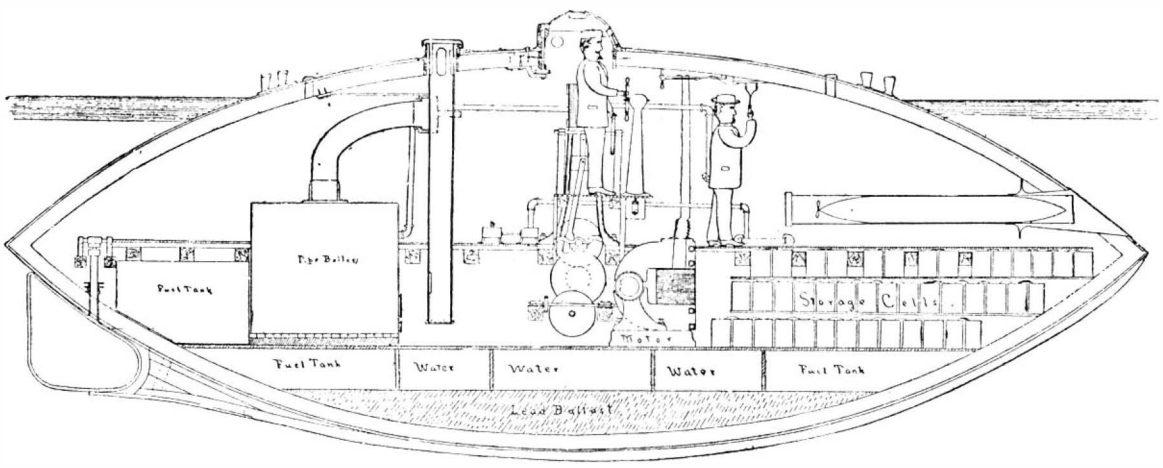
SUBMARINE BOAT—AS IT APPEARS UNDER WATER.

It is expected that, ordinarily, only two men will be necessary to operate the boat, a pilot and an electrical engineer, and the air supply needed for their comfortable maintenance under water will, it is intended, be afforded by the quantity held by the hull itself at the time of submergence, this volume being equal to 1,500 cubic feet. In one of the trials two occupants were within the closed vessel two hours and forty-five minutes without experiencing any unpleasant effects. The boat has about 75 tons displacement, the hull weighing 20 tons, the ballast 30 tons, the storage battery cells 10 tons, engine and boiler and gearing 8 tons, and motor 3 tons, leaving 4 tons buoyancy. The normal draught of the boat leaves about two feet of the crown of the hull above water.

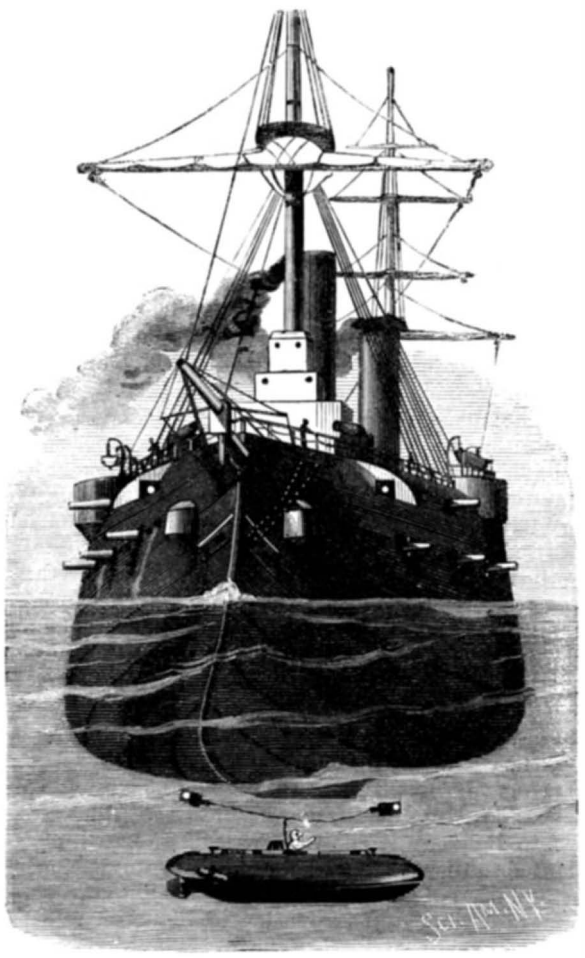


SUBMARINE BOAT—JUST BEFORE STARTING.

In starting, the pilot and electrical engineer enter through a man-hole in the conning tower, and the cover is drawn over and fastened, when the boat is air-tight. The electrically-connected pump is started and two or three tons of water is pumped into the water bottoms, this additional weight leaving nothing of the boat above the surface except the top of the hull and conning tower. To sink directly downward the wheels are turned perpendicularly to the shaft and the motor is started. The amount of spare buoyancy determines the amount of power necessary to sink the boat. When the desired depth is attained, then the propeller wheels are turned at an angle of about 45 deg. and the boat is propelled forward, neither rising or sinking unless the pitch of the wheels is changed. When the commander or pilot wishes to ascend, the machinery is stopped and the reserve buoyancy causes the boat to rise to the surface. Any accident that would stop the machinery would also cause the boat to ascend. The storage battery plant is designed to contain enough power to run the boat three hours at a speed of eight miles an hour.



THE BAKER ELECTRICALLY-DRIVEN SUBMARINE BOAT—SECTIONAL VIEW.



THE TUCK SUBMARINE TORPEDO BOAT OF 1885.

The torpedo boat of Mr. J. L. Tuck, and the method of operating it, represented in one of the views, was built at the Delamater Iron Works in 1885. It was 30 feet long, 7½ feet broad, and 6 feet deep. It had several small compartments to be filled with water when the boat was to be sunk, and a number of 6-inch iron pipes filled with compressed air to furnish a supply for its single occupant. Its propeller was turned by an ordinary dynamo, run by storage batteries, and it had a common rudder for horizontal steerage, and a horizontal rudder for guiding it toward or away from the surface. A well-hole in the center of the deck was fitted with an air-tight hatch, from which an individual in a diver's suit, by means of suitable devices, might direct those inside in elevating, lowering and propelling the boat. It was designed with this boat to attach torpedoes to the bottom of a vessel, then run away to a safe distance and explode the torpedoes by means of wires paid out while moving away.

Irrigation in Washington.

Census Bulletin No. 198 has been prepared by Mr. F. H. Newell, special agent of the Census Office for the collection of statistics of irrigation, under the direction of Mr. John Hyde, special agent in charge of the statistics of all branches of agriculture, and relates to the State of Washington, in which there are 1,046 farms that are irrigated out of a total of 11,237 farms in the 13 counties in which irrigation is practiced. The total area of land upon which crops were raised by irrigation in the census year ending May 31, 1890, was 48,799 acres. The average size of the irrigated farms, or more strictly of irrigated portions of farms on which crops were raised, is 47 acres. The average first cost of water right is $4.03 per acre, and the average cost of preparing the soil for cultivation, including the purchase price of the land, is $10.27 per acre. The average present value of the irrigated land of the State, including buildings, etc., is reported as $50 per acre, showing an apparent profit of $34.45 per acre, less cost of buildings. The average annual cost of water is $1.75 per acre, which, deducted from the average annual value of products per acre, leaves an average annual return of $16.35 per acre.

Cause of the Unequal Wearing Away of Electric Light Carbons.

In an electric arc the positive pole is hotter than the negative, the positive showing a temperature of about 4,000° C., the negative showing a temperature of 3,000° to 3,500° C. This difference of temperature produces a counter electromotive force which acts like ohmic resistance. The cause of the positive pole wearing away twice as fast as the negative is due to this difference in temperature.

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Vibrations.

Prince Kropotkin gives an interesting article on electricity as a mode of motion, in a recent number of the *Nineteenth Century*. It summarizes the results of the latest researches as simply as their nature admits of, and the net result of seemingly conclusive experiments is that with vibrations or wave lengths in the ether:

0·000,012 to 0·000,016 in. long, we have..... .. chemical energy.
0·000,016 to 0·000,030 " " " " .... .light.
..... to 0·000,129 " " " " ....radiant heat.
..... to yds. or miles. " " " .....electricity.

If these results may be accepted, we have squarely before us the problem: Given, vibrations of any length in the "ether" (whatever that is), to modify their length at will. The problem of the transformation of energy reduces down to that. When some benefactor of mankind has solved that problem, if it ever is solved, a new era indeed in civilization will open. We may then have electricity from heat, light without heat from electricity or any other form of energy, and divers and sundry other things which we can now only dream of, or perhaps not that. When we consider that pretty much all that is now known of the real nature of electricity, heat and energy is the fruit of the last twenty years (Joule's equivalent and first series of experiments were not announced until 1849), it seems a pretty safe conclusion that science is yet young, and that all which has been yet achieved is but a trifle compared with what is yet to be achieved. Moreover, we know that in the living organism, heat and energy, energy and light, energy and electricity, are transformed into each other by some mysterious process with the greatest ease, and to a large extent according to the will or needs of the organism. It may be that this power is one of the properties of living "protoplasm," and that man will never be able to understand it or to imitate it until he has learned the secret of life itself; but all the recent tendency of science is to indicate that the secret of transforming one form of energy into any other may yet be discovered, and perhaps by very simple means, compared with which our steam engine will seem but a "relic of barbarism."

The fact that electricity, like heat, light, and radiant chemical energy, is a manifestation of energy, has long been known, but up to the last four or five years scientists have been uncertain as to the manner in which energy existed in the electric current. The old idea of an electric fluid, which is still prevalent outside of scientific circles, served to mislead investigators. At present, however, the researches of such scientists as Hertz, Lodge, Crookes, Sir William Thomson and Tesla seem to have established the fact that electricity, like heat and light, is merely a vibration in the so-called "ether" which is believed to permeate all space. It is notable that all the original theories as to what we now call forms of energy were materialistic. The Newtonian (corpuscular) theory of light, which was the generally accepted one for half a century, was that light was an effect produced by an incessant fire of infinitesimal but material cannon balls thrown off in all directions from the light-giving body. Heat was a material something stored in the pores of the visible body. Electricity was a "fluid." All these assumed material substances have been shown to be non-existent, and not necessary to explain the phenomena. But there still remains one grave difficulty with the later theories. The notion of a material ether itself is almost as contrary to what we know of the nature of other matter as the corpuscular theory of light, and almost as much a mere evolution of the scientific inner consciousness, to explain what is otherwise inexplicable. We have not a particle of direct evidence to prove that there is a substance with properties such as we assign to this ether. We have only to eliminate the notion of a material ether, as we have eliminated the notion of material light particles, and we shall be down to hard pan! "I believe because it is impossible," the old monk declared. The modern scientific man, possibly, would do well to reverse this logic and declare: I disbelieve because it is so very convenient a theory, with nothing but its convenience to support it.—*Engineering News.*

A New Metallic and Rubber Wire Mat.

A new style of woven wire mat, to which is attached a soft rubber cleaner, with edges and top roughened to fit every shape in the sides or edges of boots and shoes, has recently been patented and put upon the market by Messrs. Emerson & Midgley, of Beaver Falls, Pa. Another description of mat or rug coming from the same firm is made of variously colored galvanized wire and has a thin rubber strip held on its edges by polished metal loops, the construction being such that there is no point upon which the most delicate trail of a lady's garment is liable to catch. The mats lie loosely on the floor, without fastening, so that they can be readily lifted, rolled up, and washed or shaken, and are furnished lettered as desired, three inch brass letters being used for the purpose. A mat of this kind is now in use at the entrance of the SCIENTIFIC AMERICAN office. They are manufactured by the Trenton Iron Company.

POLYCHROME PROJECTIONS BY MEANS OF UNCOLORED PHOTOGRAPHS.

For the last two years there has been much talk in the United States on the subject of a remarkable application of photography to the reproduction of natural colors—an invention attributed to Mr. Ives, of Philadelphia.

In reality, Mr. Ives, who is a very ingenious scientist and a fortunate investigator, has, aside from a few variants, merely put in practice a process published in France in 1869 by Mr. Louis Ducos du Hauron and Mr. C. Cros.

These two inventors, without any connection existing between them (Mr. Cros living in Paris and Mr. Du Hauron in Agen), conceived the same idea at about the same time. It consisted in the use of photography in the decomposing of the essential colors of any polychrome object whatever. The method published by each of them is nearly the same, and leads to the obtaining of three negatives of the same object, prototypes that are identical with each other as regards lines and dimensions, but different as regards the manner in which the various colors are reproduced.

This result, obtained by means of photography, is analogous to that sought for by a chromolithographer when he is executing the various monochromes of a subject upon stone, and which correspond to distinct colors, the superposition of which, at the moment of printing, are to give a polychrome nearly like the original. The work of selection due to photography may be so nearly complete that three negatives, the positive impression of which will be done with the three colors, yellow, red, and blue, may suffice for the obtaining of a most satisfactory polychrome image.

As a proof of the exactitude of the method devised by them, Messrs. Du Hauron and Cros have published various methods of recognizing the value of their photographic analysis of the colors of an object. Among the number of the synthetic processes that they have described there is one to which it is well to call more especial attention, because it consists in the use of a projection, upon a screen, of a combination of three positive pictures, each illuminated through a medium of a different color. The recomposition of the true colors is to be effected upon the screen.

It is useless to dwell upon the error committed by the two inventors when they say that the colored media should be yellow, red, and blue. They recognized this error later on, and in March, 1879, Mr. Cros, who, moreover, had come to an agreement concerning it with Mr. Du Hauron, distinctly directed the use of violet, green, and red screens.

We desire to well establish this question of priority in favor of our two fellow countrymen, not only because there seems to be a disposition on the other side of the Atlantic to consider Mr. Ives as the inventor of the process that we are about to describe, but also because the experiments relative to this process, now being tried in France, are of a nature to cause its adoption with a view to substituting, in cases where the thing will be possible, polychrome for colorless projections, which are evidently less attractive.

There is reason to hope that many lecturers will soon have recourse to these kinds of projections of a truly fascinating effect, and we must then know who were the inventors of this so curious an application of photography, which is perhaps destined to render many services, as yet unforeseen, to science and the fine arts.

This act of justice accomplished, we shall try to explain, as clearly as possible, the principles that serve as a basis to these photographic projections, in order that the bringing of them into play may be more easily understood.

In the first place, it is necessary to produce the three negatives of which it has just been a question. Upon the good quality of these will depend the success of the final synthesis. They should, as we have said, be identical with each other as regards dimensions, but differ as to the rendering of the distinct colors of the original.

An example will make the result that it is a question of obtaining better understood. Let us suppose that we have to analyze the colors of a polychrome object composed of three colors, yellow, red, and blue. We shall have to obtain a first negative containing the yellows and the combinations thereof, a second containing the reds and their combinations, and, finally, a third negative corresponding to the blues and their combinations. It is evident that if this result can be obtained, we shall have effected a decomposition such that the mixture of the radiations corresponding to each of these three colors, and assorted by the positives and in the desired proportions, will necessarily recompose the total coloration of the object reproduced.

Owing to the property that certain coloring substances possess of modifying the nature of films sensitive to light, it is possible to use sensitized plates adapted to the printing of blue and violet radiations to the exclusion of green, yellow, and red, or of yellow and green radiations to the exclusion of blue and red, or, finally, of yellow and red to the exclusion of blue.

The three prototypes of the same object will have to be reproduced in a camera of the same focus, the first upon the sensitized film most susceptible of receiving the impression of the blue radiations. A plate called "ordinary" is the one most suitable, since such plates, as well known, are not very sensitive to green, yellow, and red radiations. The second negative will be taken upon a sensitized film capable of receiving the yellow and green radiations, but not the red. These kinds of plates are easily obtained by incorporating with the sensitized film a dye that possesses the property of absorbing the yellow and green rays.

At the same time there should be interposed between the plate and the objective a translucent yellow screen for the purpose of retarding the action of the blue rays.

In order to obtain the third prototype, we use a plate treated like the preceding, but with a dye that gives it sensitiveness to the red rays as well as to the yellow. As for the blue, they must have no action upon this plate, such action being prevented by means of an orange-yellow screen.

As soon as a few experiments on the analysis or decomposition of colors have been made in this way, which is absolute only as regards the result to be obtained, but which is susceptible of modifications as regards the means to be employed, we shall have sufficiently mastered the process to succeed every time. After the negatives have been obtained, two methods of employing them are at our disposal. They may be used for pigmentary impressions of polychrome images analogous to those of chromolithography, and in this case it will be necessary to superpose the three monochromes, yellow, blue, and red, furnished by each negative corresponding to each of these three colors.

We have not to occupy ourselves at this moment with such application, as interesting as it is. The other application, which forms the main object of this article, relates to polychrome projections. It is well to remark, only, that when it is a question of projections, the colored media are not the same as in the case of pigmentary impressions, although the negatives are the same. For such impressions it would be absolutely impossible to attain the object if we employed ternary yellow, red, and blue, while the use of the same ternary in the recomposition of the colors by means of radiations would give improbable effects of color. Such recomposition can be effected only by the aid of the three primary colors indicated by Young and Helmholtz, viz., violet, green, and red.

We remark, in fact, that if we mix these three radiations by projecting them separately upon the same point of a white screen, we obtain pure white—a result that is not produced with the mixture of the blue, yellow, and red radiations made under the same conditions.

Now it is found that the color of each of the media to be employed is precisely the complementary of the color adapted to the pigmentary impression. Thus the negative which would furnish the pigmentary yellow will give, in view of the projection, a diapositive that it will be necessary to cause violet radiations to traverse—violet being the complementary color of yellow.

The negative of the pigmentary red is that which produces the diapositive to be illuminated in green, the latter being the complementary of red.

Finally, the negative of the pigmentary blue is that which, for the projection, will give the diapositive of orange yellow, the complementary of blue. Thanks to these preliminary explanations, the facts that are to follow and that we are going to explain will be better understood.

The putting in practice of the recomposition of colors requires the use of a lantern in three parts, or, at least, of a special apparatus constituting a single lantern provided with three projection objectives. To simplify things, let us be content for the time being with the ordinary three-bodied apparatus constructed by Mr. Moltine, which has been used by us for our own experiments. This apparatus is represented in perspective and in action in Fig. 1, and the arrangement of it is shown by the diagram in Fig. 2. Three distinct luminous sources, F, F, F, illuminate the lanterns, 1, 2, and 3. Such illumination may be furnished by an oxyhydrogen light or by electricity, or else by kerosene lamps or illuminating gas with Auer burners. The three black diapositives are placed at D, D, D, and behind each of them is located the colored medium corresponding to the analytical value of the diapositive appropriate to its special radiations. Behind D, therefore, is placed a violet glass, behind D No. 2 a green glass, and behind D No. 3 an orange yellow one.

The projections of the three uncolored (black) monochromes, D, D, D, are exactly blended into a single image perfectly registered upon the screen, I, I', I'', on which the three objectives, *o*, *o'*, *o''*, project the image.

Each of these three radiations, as shown in the diagram, reaches all the parts of the composite image projected; and from the combinations with each other of these three sorts of radiations, violet, green, and red, result all the possible colors that can be obtained with the seven colors of the spectrum. We have a proof of this, moreover, when we witness the truly wonderful spectacle of the immediate recomposition upon the screen of the infinite shades of color of the original, and

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this synthesis is indeed one of the most curious experiments in optics that can be made for demonstrating the relations that exist between the colors called primary and the unlimited variety of the various tones that they are capable of producing on combining with each other.

It will be understood that, since the violet, green, and orange-yellow radiations produce white through their admixture, white will be produced in the composite image in colors at every point where the parts of such image correspond to points of the negatives likewise traversed by the three sorts of radiations. On the contrary, where the diapositives present spaces likewise opaque, black will be produced upon the screen, and, for all the intermediate values, going from white to black, we shall have combinations in variable proportions according to the respective opacities of the diapositives, and, consequently, colors or shades varying by reason of such proportions.

If the green and red radiations are absolutely arrested in two symmetrically corresponding points, the blue radiations alone traversing the diapositive of such radiations, the screen will receive the blue color all by itself. If the green radiations are alone suppressed, while blue and red radiations pass over two symmetrical points, there will be a resultant of a more or less reddish or of a more or less bluish violet upon the screen, according as the dominant resultant is found in the greater translucency of the diapositive of the red or of the blue radiations, and so on *ad infinitum*.

At first sight, it may seem difficult to reach the desired result when we reflect that we are in presence of twelve variables which it is necessary to bring into a state of perfect accordance in order that the composite image sought shall effect the exact reproduction of a given polychrome object. These twelve variables are the three negatives, the three diapositives, the three colored media, and the three sources of light. If a single one of these twelve unities be modified, there may result therefrom a modification of the polychrome projected, to the detriment of the accuracy of the rendering. This is true, but we must not get scared in the presence of such a difficulty, for it is easily surmounted.

The obtaining of the three negatives, in suitable conditions, can be quite regularly effected. As for the diapositives, they are easily printed upon plates sensitized with gelatino-chloride of silver, and, with a little familiarity with the method, one may know when to stop at the most apposite point. One is always free, moreover, after a trial, to make the necessary correction if it is indicated by an inexact result.

The colored media should present, in the first place, the essential condition of furnishing pure white through the mixture of their three radiations. After a few tentatives, we shall quickly find those that best lead to the effect sought, and thereafter it will be useless to modify the three colors adopted. They will then pass to the state of constant.

As for the illumination, it is not indispensable that they shall be absolutely identical in the three lanterns. There is even a certain advantage in being able to modify the intensity according as it is desired to bring out a dominant in the three radiations. With gas or the oxyhydrogen light, it is merely a question of cocks, and the operator can thus regulate the effect of the projection at will by graduating the intensity of the luminous sources corresponding to each of the diapositives.

To tell the truth, these twelve variables are reduced to three, say to the prototypes, of the value upon which depends all the rest, nothing being easier, if one or more of the diapositives are too strong or too weak, than to make others of the desired intensity.

Upon the whole, the three diapositives represent the colors collectively of any polychrome object whatever, provided that they be projected, as has just been said, by means of three objectives, and traversed by the three distinct radiations that have been indicated.

This process of synthesis offers the great advantage of permitting of obtaining the representation of the colors of nature and of works of art without the intervention of the brush, and without the interpretation, however able it be, of any translator whatever. Our first tentatives in this direction, susceptible of leading to numerous applications of great interest, permit us to believe that it is possible to reach perfection in the rendering of colors. The images thus projected are fugitive, it is true, yet we can succeed in fixing them in a less striking but also less exact manner, through pigmentary impression by means of the same negatives. In that way, the method of the photographic decomposition of colors, combined with certain easily employed correctives, leads to results that are remarkable and much superior to anything that can be obtained thus by the use of the ordinary processes of chromolithography or chromotypography.

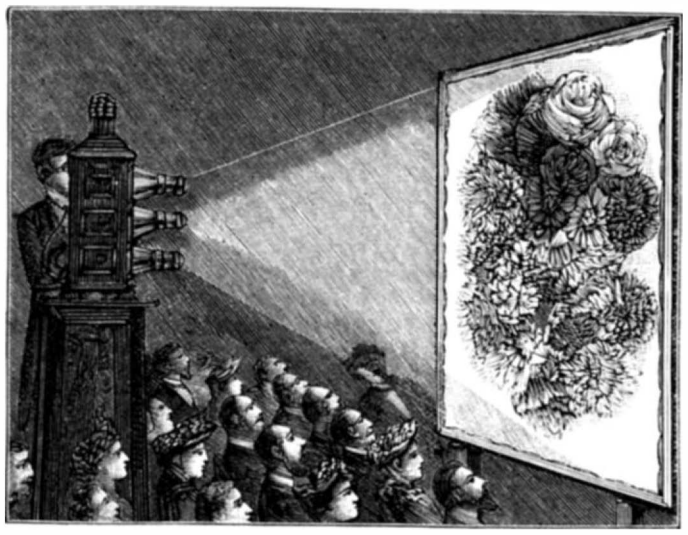

Fig. 1.—PROJECTION BY MEANS OF A TRIPLE-BODIED LANTERN.

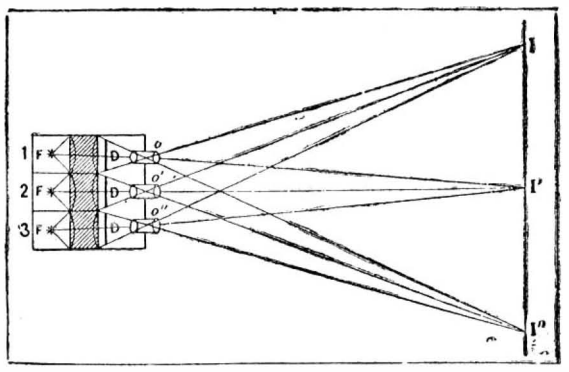

Fig. 2.—DIAGRAM OF THE APPARATUS.

The first public experiments in France on this method of recomposing colors by way of projection took place at the Conservatoire National des Arts et Metiers in our lecture of February 7, 1892. Since then they have been repeated, with completer elements, at the session of the French Society of Photography of the 4th of March, and before the Photo. Club, of Paris, on the 9th of March.

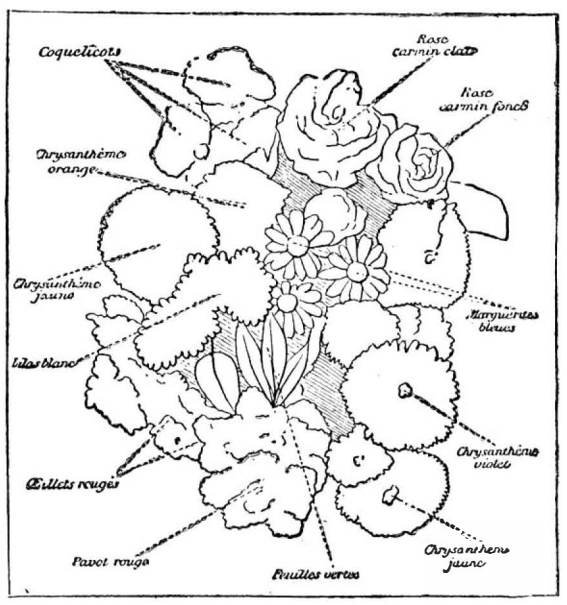

Fig. 6.—DIAGRAM SHOWING THE COLORS OF THE FLOWERS REPRESENTED IN THE FIGURES.

The three engravings (Figs. 3, 4, and 5) represent, in its three states, one of the subjects projected, the diagram of which in Fig. 6 indicates the colors. These three images are a reproduction of the same bouquet of artificial flowers under the special conditions detailed above. If we compare with each other the corn poppies at the top and at the left, we find that they nearly resemble one another in Figs. 4 and 5, where they are rendered by a color almost black, while they are white in Fig. 3. The yellow flower situated beneath and to the right of the bouquet is of a dark shade in Fig. 5, and, on the contrary, nearly white in Figs. 3 and 4. The yellow centers of the daisies are black in Fig. 5, and of a light tint in Fig. 4, and still lighter in Fig. 3.

Two of the daisies were purposely colored with ultramarine. In the last two images, 4 and 5, these are nearly white, like the white daisy, while in the first (3), from which the action of the blue rays was excluded, they have a vigor comparable to that of the green of the leaves.

It seems to us useless to carry the comparison farther; it suffices to show the dissimilitude that exists between these three diapositives, as regards the rendering of the colors, although identical in their lines and dimensions. It will be remarked that the white lilac is everywhere found reproduced with an equal value, the white having acted in the same manner upon the three sensitized films, possessing solely different properties as regards the simple colors.

The favorable reception accorded by the numerous spectators present at these experiments is a sure guarantee of the future in store in France for the use of this method of polychrome projection. It has been almost unknown there up to the present, although its inventors are Frenchmen. The proof of a possible perfect realization has now been given, and there is nothing more to do but construct apparatus adapted to this special object—cameras and lanterns designed for obtaining negatives and the projection of their diapositives. We know that skillful constructors have already taken the work in hand.

What a splendid application for our intelligent and artistic amateurs is that which is to permit them to bring back from their excursions photographic images that it will be only necessary for them to project in a composite state upon a screen in order to show their friends or others the places visited, and cause them to admire not only the picturesque character but also the beautiful colors thereof.—*La Nature.*

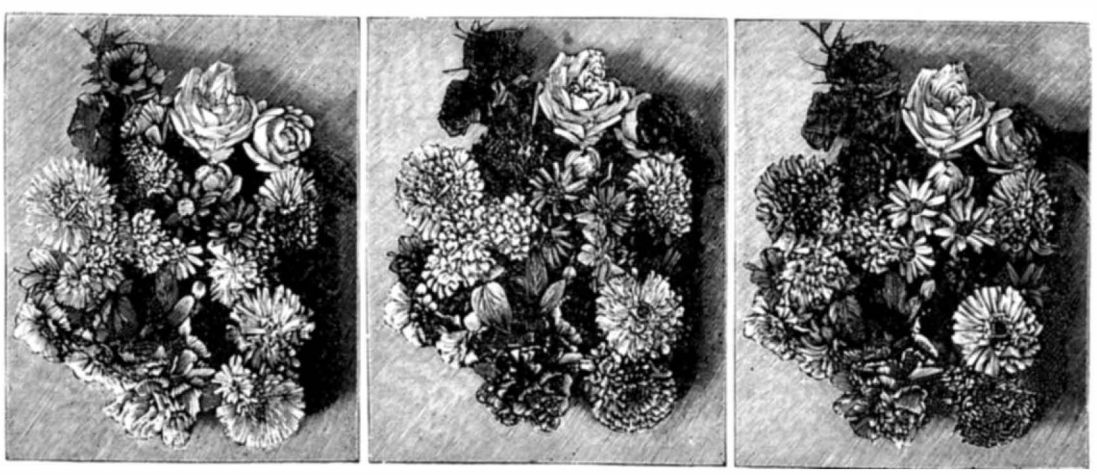

Fig. 3. Fig. 4. Fig. 5.

Fig. 3.—Monochrome designed for giving red, in the state of diapositive; monochrome of blue for the printing of pigmentary colors. Fig. 4.—Diapositive that gives green radiations; monochrome of red for the printing of pigmentary colors. Fig. 5.—Diapositive that gives blue radiations; monochrome of yellow for printing with pigmentary colors.

Analysis of Iron.

In a paper read before the Chemical Society, Messrs. A. E. Barrow and Thomas Turner gave results of analyses of best bar and sheet iron and common bar and sheet iron. They attempted to estimate the slag by combustion in chlorine, a method already employed by one of them for cast iron (C. S. Trans. 45, 263), but they found that the iron was attacked by the chlorine, the action taking place quite sharply at a scarcely visible red heat. A considerable number of iron ores and slags were examined, and it was found that action takes place in the sense of the equation $3FeO=Fe_2O_3+Fe$, the iron being removed by volatilization as ferric chloride. This action was unexpected, and so far as the authors are aware, has not been observed before. Deville has, however, shown that when ferrous oxide is heated in hydrogen chloride, it yields magnetic oxide of iron and ferrous chloride. They then dissolved the iron in cold solution of sodium copper chloride. The authors conclude that for practical purposes the weight of slag in best and common iron may be taken as identical, and that on reheating and rolling each loses about the same weight of slag. The additional loss noticed on reheating impure iron is due chiefly to the elimination of phosphorus, probably in the form of ferrous phosphate.

Length of Street Railway Cables.

Among the longest cables made by the Washburn & Moen Manufacturing Company were one manufactured for the Denver Tramway Company, of Denver, which was 32,145 feet in length, weighing 86,867 pounds; one manufactured for the Portland Cable Railway Company, which was 33,000 feet in length, weighing 76,350 pounds; and another manufactured for the Metropolitan Street Railway Company, of Kansas City, 32,300 feet in length, and weighing 95,200 pounds.

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Conscience in Work.

The policy of right doing cannot be doubted. Every intelligent man and woman must see that in nearly every instance it pays richly and fully for whatever labor or self-sacrifice it may involve, and in the few cases where they cannot see this result most of them have sufficient faith in the law to trust it. Yet, if this be the only motive in action, it cannot be called right doing in the best sense. That which is done solely from the hope of gain or advantage cannot be of the highest type.

The habit of doing what we have to do as well, as thoroughly and as speedily as possible, without immediate reference to its probable or possible effects upon ourselves, is one which would of itself secure at once the best success for ourselves and the greatest good of the community. It would settle many vexed questions and solve many knotty problems. Instead of this, the common course is to consider closely the comparative benefit that is likely to accrue to us in return. There are all degrees of this calculation, from the strictly just to the grossly selfish. One man tries to estimate the true worth of his labor and performs it accordingly, another gives as little work and secures as large returns as possible, and between these there is every shade. But in all such reckonings there is one important element left out. No one can count up the value of the labor which is both generous and conscientious. Even its money value can never be calculated.

The youth who enters business determined to do all that comes to his hands as well and as quickly as he can, who is anxious to learn and anxious to please, who never measures his labor by his wages, but freely gives all the work and the best work in his power, is vastly more valuable than the one who is always bearing in mind the small pay he is receiving and fearing that he should give too much in return. So the mechanic or the clerk who, beyond his stated salary, beyond even his obligations to his employer or the demands which public opinion could make upon him, exerts himself to make his work as perfect as he can, and delights in its thoroughness and excellence, apart from any private benefit it can render him, has a value which can never be computed. It matters not what the work be, whether it be done with the spade of the laborer, the pen of the clerk, the brush of the artist, or the voice of the statesman. Such people are sought far and wide, there are places always open to them, and their services are always at a premium. Talents and skill tell for much, but conscience in work tells for more. He whose integrity is unquestionable, who can be trusted far and wide, who will work equally well alone as when every eye is upon him, and will do his best at all times, is an invaluable member of society. And he cannot do this simply from the motive of self-interest. It is the result of something more than intelligence and foresight, it is conscience, vitalizing every detail of labor, and raising it to its highest pitch of excellence.—Condensed from a lengthy editorial in the *Confectioners' Journal.*

An Observatory for Mont Blanc.

A second attempt is to be made to build an observatory at the top of Mont Blanc. As the workmen who tunneled last year through the snow just below the summit did not come upon rock, M. Janssen has decided that the building shall be erected on the frozen snow. A wooden cabin was put up, as an experiment, at the end of last summer, and in January and early in the spring it was found that no movement had occurred. According to the Lucerne correspondent of the *Times*, the observatory is to be a wooden building 8 meters long and 4 meters wide, and consisting of two floors, each with two rooms. The lower floor, which is to be embedded in the snow, will be placed at the disposition of climbers and guides, and the upper floor reserved for the purposes of the observatory. The roof, which is to be almost flat, will be furnished with a balustrade, running round it, together with a cupola for observations. The whole building will rest upon six powerful screw jacks, so that the equilibrium may be restored if there be any displacement of the snow foundations. The building is now being made in Paris, and will shortly be brought in sections to Chamounix. The transport of the building from Chamounix to the summit of Mont Blanc and its erection there have been intrusted to the charge of two capable guides—Frederick Payot and Jules Bossonay.

CORNELL UNIVERSITY had, in 1891-92, a larger number of students in her technical departments than any of the nine technical colleges of Germany, with the single exception of Berlin (Charlottenburg). Sibley College, in its courses in mechanical engineering alone, has a larger number of students than the total in any German technical college except Berlin, Munich and Carlsruhe. The following are the figures: Berlin, 1,756; Cornell, 1,090; Munich, 642; Carlsruhe, 586; Sibley, 525; Hanover, 514; Stuttgart, 363; Darmstadt, 334; Dresden, 251; Brunswick, 237; Aachen, 110.

When it is considered that the German colleges are the wards of the state, and are fully supported by their guardians, while Cornell University and its technical colleges are the wards of New York State, and left to be supported by private liberality, the contrast is something remarkably creditable to the latter, and not at all to the State so greatly benefited.

New Pacific Mail Steamer.

A new steamship, the Peru, for the Pacific Mail Steamship Company, was launched on the 11th from the yards of the Union Iron Works at San Francisco. The Peru is a steel steamer, 350 feet long, with triple expansion engines of 2,800 horse power, and is expected to attain a speed of 15 knots per hour.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING. — Robert S. Russell, Brownsville, Tenn. This is an improvement in that class of devices known as "twin-jaw" couplers, a coupling jaw of novel form being pivoted within each drawhead, the jaw having a horizontal hook at its forward end and a shoulder on the lower face of its weighted rear end, while a rock shaft jonrnaled beneath the drawhead carries an arm adapted to contact with the jaw and the shoulder. The beveled forward ends of the coupling jaws pass each other as the cars come together, their hooks becoming automatically engaged, means being provided for locking the parts in coupled or nncoupled position. This coupling is inexpensive and always safe, and the device is readily operated from the side of the car.

MAIL BAG CATCHER.—James W. Horton, Madison, Ind. Catching and holding arms, normally pendent, are secured to a main or supporting bar hung in bearings npon the outer faces of the car door posts, these arms being swung out into operative or horizontal position by a lever arm. The catcher arms are adapted to be readily reversed to operate in either direction of movement of the car, the arms positively grasping the bag, while the holding devices yield to its inertia to overcome the shock. The device is simple in construction and easy to manipulate.

BAGGAGE STAMP OR CHECK.—Thomas M. Cunningham, Nashville, Tenn. This invention consists of a railroad ticket having separate and independent stamps or checks secured to it indicating the amount collected by the initial road on the route for the baggage of the passenger, with other particulars, such as the excess in value and excess weight of the baggage. The improvement has for its object the more certain division pro rata of charges for excess of baggage on connecting railroads using coupon tickets, although it is likewise applicable to local tickets.

Mechanical.

GRINDING WHEEL ATTACHMENT. — John H. Goetsche, San Francisco, Cal. Emery and other grinding wheels are, by this improvement, provided with a casing formed with an annular recess to retain the oil, the inner wall of the casing resting on the face of the wheel and being held in place by a washer. The arrangement is such that all the lubricant passing out of the bearing is readily gathered by the casing and retained therein, from which it can be readily removed by a sponge or other means, the work being protected from the oil or other lubricant ordinarily liable to be scattered over the surface of the wheel.

CLAW BAR. — James W. Gray, Brooklyn, N. Y. An implement especially adapted for drawing spikes from railroad ties, and capable of speedy and convenient adjustment to any size of spike-head, is afforded by this invention. The jaw is curved on its under side to rock, and its forward end is curved downward and inward to form a beak, in the rear of which is a vertical slot in which a bar has a sliding and pivoted movement. The construction is such that one of the clamping jaws may be utilized as a fulcrum for the bar in drawing the spike, the implement being also light, durable, and inexpensive.

Agricultural.

PLOW.— Henry M. McCafferty, Montrose, Col. A combination sulky plow and roller has been devised by this inventor, an implement designed to thoroughly plow the soil and roll it nicely at the same time, the roller forming one of the main wheels of the machine. The frame is supported by an ordinary wheel at the landside, and the land roller is hinged centrally between its ends at its forward side to the opposite side of the frame, so that it will have a free lateral swinging movement. This improvement is designed to afford especial advantages from the fact that the soil rolls better and the clods break up more easily just at the time they are turned up by the plow, and the weeds and vegetable matter are thus so effectually covered up that they rot more quickly.

FOWL CRATE.— Friedrich W. Ewert, Wood Lawn, Ill. A transverse partition divides this crate into upper and lower compartments, and transverse and longitudinal bars in each upper and lower division are made to form single compartments, one for each fowl, there being a door on the front end of each compartment formed of a bar sliding on vertical rods, guide rods held on the bar sliding in bearings on the crate. The crates are more especially designed for shipping fowls to a distance without injury, perfect ventilation being afforded, and the construction being simple and durable.

EGG CARRYING PACKAGE.—Robert G. Dale and Walter S. Weightman, Durango, Col. The outer body of this package or case is made of pasteboard or thick paper bent or folded to form two tubular sections lying side by side, with their inner walls dividing them but left free to open, inner thin paper or flexible strips being looped to form a series of separate egg chambers in each tubular section. The improvement is more especially designed to facilitate the safe delivery of eggs in small lots to consumers, and is also applicable to egg cases of larger size, or packages containing any number of such divided lots.

CHEESE VAT.—Leopold Meyer, Ahnapee, Wis. This is an improvement upon vats having a water tank and heater, the milk being heated in a removable vat suspended upon the water tank. The milk vat has a sliding and detachable connection with the water tank, and a longitudinal discharge pipe extends along the under side of its bottom, the projecting end of the pipe entering an aperture in one end of the water tank when the vat is secured to the tank, the latter having a heating pocket in its bottom. The bottom of the sheet metal milk vat is strengthened, and a simple and convenient means provided for drawing off the whey from the curds, the tank and vat being easily separated and operated, and easily kept clean.

MUZZLE FOR HORSES AND STOCK. — Marcus S. Moremen, Switzerland, Fla. This is a simple and practical device, attachable to the head of the animal to prevent injury being done to other cattle or to trees and shrubbery, while allowing freedom to graze. The skeleton muzzle is secured upon the jowls of the beast, and its open bottom is normally closed by a pivoted and spring-pressed guard plate, a projection from the latter engaging the ground to swing the plate upward within the muzzle when the animal lowers its head.

POWDER DUSTER.—John P. Wright, Thomaston, Texas. This is an inexpensive device adapted to be carried on a farm cart or wagon, and be easily operated by the driver to distribute poison upon plants. A bed or platform carries uprights supporting a hand shaft with crank handle, this shaft being connected by a belt and pulley with a distributer shaft on the outer ends of which are poison-distributing cylinders, which may be held at different heights, as desired, for dusting the plants. The distributer shaft is operated by the turning of the crank handle by the driver, and not by the moving part of the machine, so that the powder may be applied only where needed and none of it will be wasted.

Miscellaneous.

TOY.—William H. Gregg, New York City. The evolutions of a body of soldiery can be imitated and different positions of a company of infantry may be accurately represented by this novel and amusing toy, instruction in the order of marching bodies of men being illustrated thereby. In connection with a base board, a series of figures is supported on transverse strips secured pivotally at both ends on parallel bars, and thus adapted for changing the position of the figures by ranks.

PUZZLE.—Antenor Assorati and Arturo Cuyas, New York City. A puzzle in egg form, simulating the mythical egg of Columbus, is provided by this invention, the egg being so constructed that when handled in a certain manner it may be made to stand upon its end. Although the toy is inexpensive, the interior mechanism is so arranged that it requires considerable expertness to solve the puzzle.

DESIGN FOR THE ORNAMENTATION OF SHEET METAL.—Leopold Kahn, New York City. The leading feature of this design consists of alternating strips of ribbon-like and lace-like metal, the latter figures simulating different varieties of lace, and having preferably scalloped edges overlapping the ribbon-like figures.

DESIGN FOR A SHOE SHAPER PLATE.—Joseph W. Skinner, La Crosse, Wis. The edge lines of the flat main plate converge slightly toward both ends, which are turned up at right angle, one upturned end being bent over in a curve, while in the other is inserted a screw eye.

PRESSURE REGULATING VALVE.—Walfrid Gustafsson, Brooklyn, N. Y. This invention provides a valve of simple, durable, and inexpensive construction, with which, no matter what the pressure may be upon the inlet, the pressure at the outlet may be diminished as desired. The invention also provides a means whereby the regulating mechanism of the valve may be manipulated in a convenient and expeditious manner, the improvement embracing various novel details of construction and combinations of parts.

FEED PIPE FOR VACUUM PANS. — Henry Basanta, Ponce, Porto Rico. The feed pipe is preferably ring-shaped, provided with a series of perforations, and located directly above the heating coil of the vacuum pan. One end of the pipe is closed and the other registers with a short pipe leading to a chamber into which discharges the supply pipe, valved steam and chemical supply pipes being also connected with this chamber, the valves in the latter pipes being ordinarily closed. The regular perforations in the feed pipe cause a uniform discharge of the sirup under an equally distributed pressure, any crystals in the sirup not being liable to break, and facilitating the production of well-grained sugar in the boiling.

TRANSFER PAPER.—William Schwartz, New York City. This invention relates to an improvement in the paper and in a composition for coating it, providing at a low cost a paper by means of which a number of copies of a manuscript or design may be quickly and conveniently taken on single sheets or on the leaves of books. The coating is composed of glycerine, carpenter's glue, agar-agar, and other components, in specified proportions, and is applied while hot. The compound never thoroughly dries, but always retains its absorbent qualities, and with the paper thus treated a distinct and perfect impression is made of the matter to be copied.

HARNESS. — Thomas J. Magruder, Marion, Ohio. This is a strap-attaching device for harness, of simple and durable character, especially adapted for connecting the inner and outer belly-bands, or for connecting any two straps crossing one another. The device has side bars with upwardly curved extremities from which tongnes extend inwardly, a bridge bar connecting the side bars, the bridge bar having studs and a central aperture.

SACK HOLDER. — James C. Bratney, Sparta, Ill. This is a device for holding any kind of sack in a position to be easily filled, and is readily adjustable to suit and support sacks of different lengths. The holder has a funnel top, with depending neck to enter the sack, and on opposite sides of the funnel are downwardly-depending sockets to receive supporting legs. The funnel has projections or teeth and hooks to engage the sack, which may be fastened in place by one motion of the hand, and thus held without injury, the hooks not extending through the fabric, but simply forcing it into aligning perforations.

EMBROIDERING.—Hermann Gehnrich, New York City. Thie invention relates to a fabric-holding frame for embroidering machines, and especially adapted for use with the Heilmann or Swiss machines. The frame may be secured to the machine in any well known manner, is of simple and inexpensive construction, occupies but little space, and the fabric can be readily and securely attached to it and stretched without injury. It is provided with an automatically-working lock, so that when the fabric is stretched it will be held under the desired tension.

SHOW CASE. — James C. Loughry, Greensburg, Pa. This case is especially adapted to exhibit cigars and permit them to be easily reached. It has a vertically-sliding glazed front, operated in ways by chains or cords extended over guide pulleys to the rear of the case and there weighted for operation by the salesman, there being a shield or mirror in front of the upper ends of the ways. The salesman pulls on the chain to raise the glass front when a customer desires to select a cigar.

COMBINATION LOCK. — William H. Thompson, Winnipeg, Canada. This lock has a rotary bolt with a locking notch in which rests a tumbler on a spring bar, at right angles to and operating on which is a grooved pull-shaft, in the grooves of which play one or more adjustable slides. The lock can be opened only by one knowing the proper combination, and is adapted for use on cupboard doors, drawers, valises, and in connection with the ordinary bolts of safe locks.

STOVEPIPE FASTENING. — John H. Johnston, Little Rock, Ark. Metal loops are, according to this invention, riveted to the pipe sections on the inside near their ends, a separate connecting strap or tie being bent around the loops and connecting the opposite pipe sections, thus forming a firm and secure union of the sections to prevent them from becoming loose and falling apart, without producing any visible or unsightly effect.

FURNITURE CONSTRUCTION. — Frank M. Harman and Andrew L. Eaton, of Ottumwa, Iowa. This invention provides a convenient means of securing the legs to tables, stands, desks, and similar articles, temporarily for shipment. A diagonal right and left screw bolt is made to connect the rails in the rear of their spaced ends, the leg being clamped between the rail ends beyond the screw, which serves to connect and brace the rails when the leg is removed.

FISH HOOK.—William H. Hunter, Farnhamville, Iowa. A bowl and two hooks are combined in this improvement, the shank of one hook being fixed in the bowl while the shank of the other hook engages a pin or lug on the bowl to hold the two hooks in a closed position. While trolling the hooks are thus held closed to prevent them from getting caught in weeds, grasses, etc., but they are adapted to open instantly when the fish takes the bait.

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WOOD AND COAL BOX.—Rudolph Federroll, New York City. This box is preferably made of metal, and has an open-topped case in which slides a wood box, the box being mounted on rollers so that it may be easily moved about. The lower portion of the box is divided into upper and lower compartments by an inclined partition, in which is an opening, there being also an opening closed by a vertically-swinging door in the front of the lower compartment. The box is cheap and compact, and holds the coal in such a manner that it may be easily shoveled out without spilling.

DETERGENT PASTE. — Joseph Judge, Pittston, Pa. This is a paste for scouring and polishing purposes. It may be used for polishing and scouring hot or cold metals without much labor, its action being very rapid upon rust, corrosion or discolorations of the surface, and it leaves a polish which will last for a considerable length of time.

HAT.—Samuel Cohen, New York City. This is a hat more especially designed for the use of hunters, etc., having a sufficiently stiff brim to afford protection against the sun and rain, while it may be readily folded up to carry in the pocket. The brim is made in sections folding one upon the other, and the hat is made of a covering material and lining between which are interposed stiffening plates made of cardboard, rubber, leather, metal, etc., joints being formed by the covering material and lining at the ends of adjacent plates.

VAGINAL SYRINGE. — John D. Kirkwood, Pullman, Washington. This a device of novel construction, made in one piece, without joint or seam or screw thread, so that dirt or other matters cannot collect in it, while it has no weak part to break and is not liable to get out of order.

DESIGN FOR A MEDAL. — Albert O. Quinby and Thomas H. Bates, Fresno, Cal. This is a Chicago World's Fair souvenir, and has on it a representation of a spread eagle surmounting a shield-like figure bearing a bird's eye view of the exposition buildings.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN

BUILDING EDITION.

JULY NUMBER.—(No. 81.)

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1. Handsome plate in colors of a residence recently erected at Yonkers, N. Y. Perspective views, floor plans, etc. Messrs. Rossiter & Wright, architects, New York. An excellent design.
2. Plate in colors of a residence erected at Marina Heights, Black Rock, Conn. Perspective elevations and floor plans. Cost $7,000 complete. Henry Lambert, architect, Bridgeport, Conn.
3. Perspective view and floor plans of a brick house at Chambersburg Pa., recently designed and built at a cost of $2,500.
4. A cottage near Orange, N. J., from plans prepared by Munn & Co., architects, New York. Cost $7,000 complete. Perspective view and floor plans.
5. A residence at Portland, Me., erected at a cost of $5,575 complete. Floor plans and perspective elevation.
6. A residence at Bensonhurst, Long Island. Cost $9,800 complete. Messrs. Parfitt Bros., architects, Brooklyn, N. Y. Two perspective elevations and floor plans.
7. Perspective elevations and interior views of the American Yacht Club House, at Milton Point near Rye, N. Y. A handsome building of the Queen Anne style. Messrs. E. A. Sargent & Co., architects, New York.
8. A dwelling at Upper Montclair, N. J., erected at a cost of $7,000 complete. Messrs. Munn & Co., architects, New York. Perspective and floor plans.
9. A cottage at Babylon, Long Island, N. Y., erected at a cost of $3,700 complete. Plans and perspective elevation.
10. Sketch of an Australian bush home. Cost from $1,200 to $1,500. A simple and economical design for a summer house.
11. Miscellaneous contents: Electrical cotton gin.—Aluminum.—The efflorescence on brickwork.—Leaf photography.—Car roofing.—Superior steel furnaces, illustrated.—How to stain wood yellow and gray.—Ink for writing on glass or porcelain.—An improved wood-working machine, illustrated.—An improved revolving chimney top, illustrated.—Elevators in the amphitheater of Rome.—An improved hot water heater, illustrated.—Natural wood grille and screen work, illustrated.—Galvanized eaves troughs and conductors, illustrated.—Sliding blind patents.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(4465) A. R. S. wants to know what is the best proportion of materials to make a German silver which does not tarnish. A. Nickel 35 parts, tin 20 parts, zinc 18 parts, copper 16 parts, and white cast iron 10 parts.

(4466) M. J. S. writes: Having practiced taxidermy for many years, I naturally read with interest the article on "Dangers of Arsenical Soap," in SCIENTIFIC AMERICAN of April 23, 1892. For the last eighteen years I have used arsenical soap only, believing it to be less harmful than white arsenic. 1. Now if (as this article asserts) arsenic is non-volatile, and "the little arsenic it would be possible to absorb would act only as a tonic," how comes it that a single grain of arsenic in a square yard of wall paper is so injurious? A. The poisonous effect of mixtures of arsenic with organic matter by formation of volatile products is still somewhat in debate. The ill effect of arsenical wall paper is still somewhat uncertain. 2. The taxidermist receives many valuable specimens in the first stages of decay. Will not the application of white arsenic to the skins of such develop ptomaine of arsenic also? A. Ptomaines may be developed in such cases. 3. If the best white toilet soap is used, can ptomaine be developed in the arsenical soap? A. Distinction in favor of olive oil or other vegetable soap might be drawn. 4. Is there any safe, reliable substitute for arsenic in the preparation of skins? A. Arsenic seems to hold its place as the favorite application.

(4467) R. G. P. says: In the manufacture of perfumery, what portion of the plant is used? A. The odors of plants reside in different parts of them, sometimes in the roots, as in the iris and vitivert; the leaves in mint, patchouly and thyme; the stem or wood in cedar and santal; the flower in the roses and violets; the seeds in the tonquin bean and caraway; the bark in cinnamon, etc. Some plants yield more than one odor, which are quite distinct and characteristic. The orange tree, for instance, gives three; from the leaves one called petit grain; from the flowers we procure neroli; and from the rind of the fruit essential oil of orange; named Portugal. The fragrance or odor of plants is owing in nearly all cases to a volatile oil, either contained in small vessels or sacs within them or generated from time to time, during their life, as when in blossom. Some few exude, by incision, odoriferous gums, as benzoin, myrrh, etc.; others give, by the same act, what are called balsams, which appear to be mixtures of an odorous oil and an inodorous gum.

(4468) N. McH.—Commercial dextrine is obtained by heating dry potato starch to a temperature of 750° Fah., in sheet iron trays or revolving iron or copper drums, similar to those used in coffee roasting, whereby it is transformed into semi-transparent, brownish lumps, which are converted into a pale yellow powder by grinding between millstones. It is completely soluble in cold water, from which it may be precipitated by addition of excess of strong alcohol. Potato starch is generally used, but starch from other sources will answer. The best tests to ascertain its purity are to agitate briskly a few grains of the dextrine in a test tube with fifty times its weight of pure cold water, then set it aside for 10 minutes. Pure dextrine dissolves completely in cold water to a clear solution. If not all dissolved, pour off the solution, add a little water to the residue, heat to boiling, let cool, and add a few drops of iodine water; a blue color indicates starch.

(4469) W. A. B. asks: 1. I have an induction coil I made that gives a shock as strong as I can bear with a current from two cells of gravity battery. What would be the best kind of battery to use to occupy very little space and at the same time not be expensive? A. Use a plunging bichromate battery. 2. What length of focus, size of glasses, distance apart, and number of glasses should be in a microscope to magnify 350 diameters? I can make the glasses and mount them myself. If you have a SUPPLEMENT that gives information on this subject, tell me the number and I will send for it. A. The formula for a good microscope objective requires very careful calculation, and the lenses must be made of special glass and carefully corrected. We do not think you will be able to do this unless you are an expert optician. You will find information on grinding lenses in SUPPLEMENT, No. 318.

(4470) W. T. B. writes: In Sloane's "Arithmetic of Electricity," the strength of current that a copper wire can safely carry is given as 2·5 amperes for a No. 18 wire, Birmingham gauge. Other authors whose works I have vary but slightly from 8 amperes for No. 18 B. and S. gauge, a smaller wire than the other gauge. Now, will you please tell me what is the safe carrying capacity of say No. 18 B. and S. gauge copper wire? A. The 2·5 amperes is credited to No. 18 B. and S. or American wire gauge—not Birmingham. There is no hard and fast rule. The figure given in the arithmetic is for electro-magnets and amatures, where the wire is insulated. A bare wire would carry considably more. 2. What is the ratio of the current capacity of wires to their diameters? A. The square of the carrying capacity varies with the cube of the diameter. See "Arithmetic of Electricity," pages 58, 59.

(4471) R. M. McG. asks for a so-called window pane barometer. A. By painting the window pane or wall paper with any one of the following solutions, different colors are exhibited npon atmospheric changes, owing to the well known properties of nickel and cobalt salts, which change color in accordance with the variation or amount of moisture in the air. No. 1. Cobalt chloride 1 part, gelatine 1 part, water 100 parts. No. 2. Copper chloride 1 part, gelatine 10 parts, water 100 parts. No. 3. Cobalt chloride 1 part, gelatine 20 parts, water 200 parts, nickel oxide 0·75 part, copper chloride 0·25 part. In damp weather all will be colorless; in clear weather No. 1 will be blue, No. 2 yellow, and No. 3 green.

TO INVENTORS.

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July 19, 1892,

AND EACH BEARING THAT DATE.

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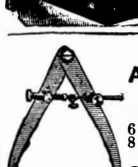
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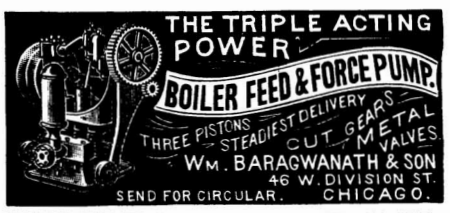

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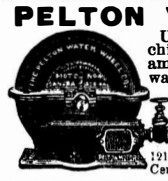
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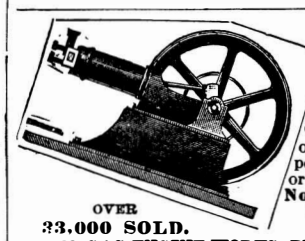
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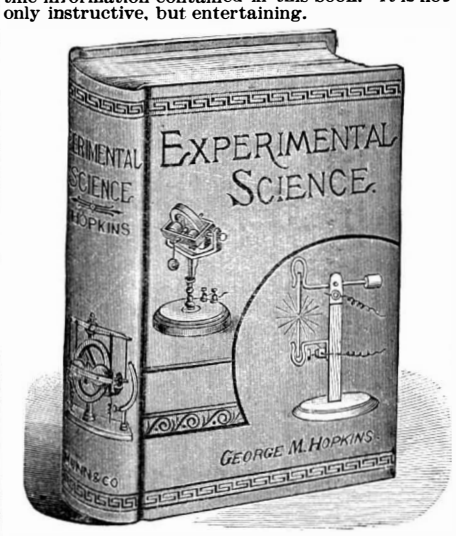

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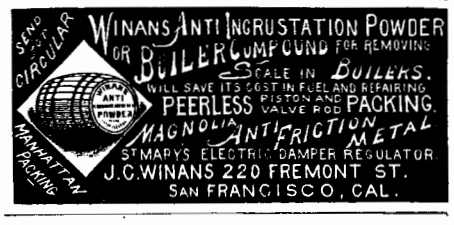
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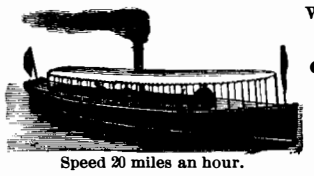

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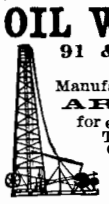

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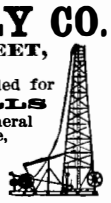

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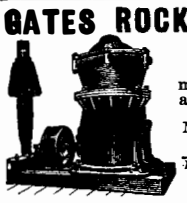

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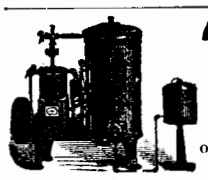

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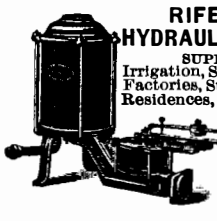

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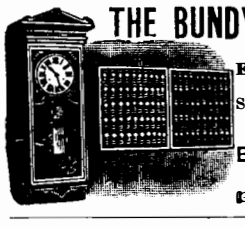

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PROPOSALS.

NOTICE TO ARCHITECTS.

THE Honorable the Chief Commissioner of Lands and Works hereby invites Architects to submit, on or before the 30th September next, (competitive) plans and estimates of cost for the construction of certain Provincial Government Buildings.
Particulars of competition and further information can be obtained from the undersigned.
W. S. GORE,
Deputy Commissioner of Lands & Works.
Lands and Works Department,
Victoria, B. C., 16th June, 1892.

NOTICE TO CONTRACTORS.

MAYOR'S OFFICE, ASHEVILLE, N. C., JUNE 30th, 1892.—Sealed proposals will be received by the Mayor and Joint Board of the City of Asheville, N. C., at this office, until 3 o'clock p. m. on the 1st day of August, 1892, for furnishing and setting up in the Pump House, on the Swannanoa River, one steam pumping engine and boiler, capacity 1,000,000 gallons in 24 hours; one power pump and water wheel, capacity 750,000 gallons in 24 hours; also for furnishing and laying about three miles of 16 inch water pipe. Plans can be seen and specifications obtained at the office of the City Engineer, Asheville, N. C. C. D. BLANTON, Mayor.
B. M. LEE, City Eng.

U. S. ENGINEER OFFICE, CUSTOM HOUSE, CINCINNATI, OHIO, July 11, 1892.—Sealed proposals for furnishing cement, lumber, tie rods and washers required for lock and movable dam No. 6, Ohio River, near Beaver, Pa., will be received at this office until 2.30 p. m. August 1, 1892, and then publicly opened. Specifications, blank forms and all available information will be furnished on application to this office.
AMOS STICKNEY, Major of Engineers, U. S. A.

U. S. ENGINEER OFFICE, CUSTOM HOUSE, CINCINNATI, OHIO, July 16, 1892.—Sealed proposals for furnishing brick, sand and stone required for lock and movable dam No. 6, Ohio River, near Beaver, Pa., will be received at this office until 2 30 p. m., August 16, 1892, and then publicly opened. Specifications, blank forms and all available information will be furnished on application to this office.
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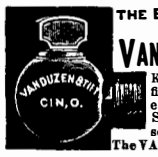

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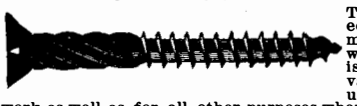

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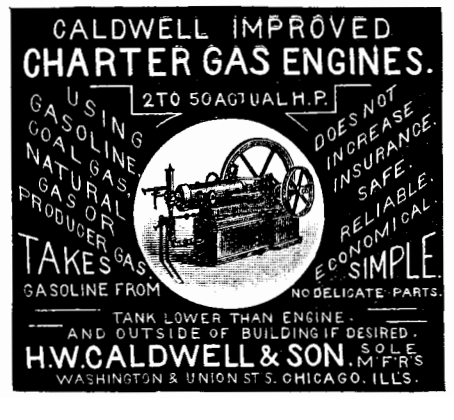

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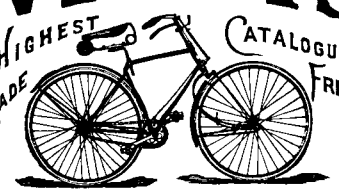

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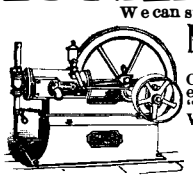

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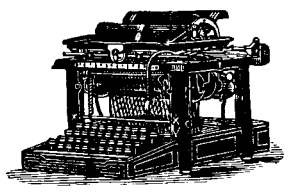

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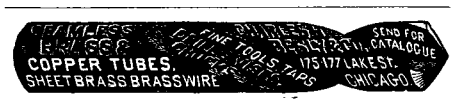

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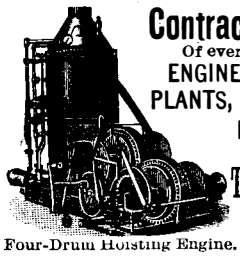

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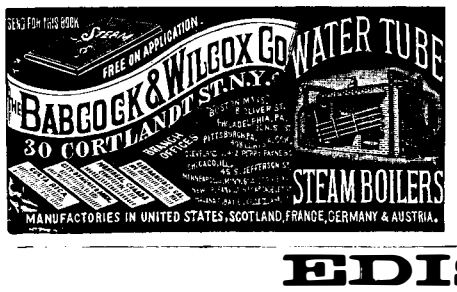

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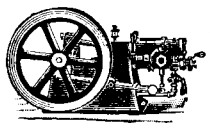

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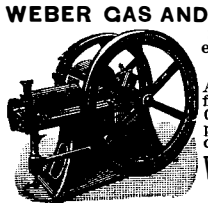

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